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Electrical World

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October 20, 1923

Report of the Pacific Coast Convention of the A.I.E.E.

Hoover Starts Action in Northeast Superpower Development

It is fitting that I should make some remark upon the remarkable progress and ability shown by the whole electrical industry since the days of Mr. Edison's initial genius. They have come to have a large vision of cooperation and service and have in very large measure realized their responsibilities to the public. One great mark of their progress is that despite the greatly increased cost of labor, coal and other materials, there is but little if any increase in the cost of light and power to the consumer today over prewar prices. Under the protection of state regulatory bodies over 2,000,000 of our people have invested their savings in this industry. From an annual utility production of four billion kw. hours twenty years ago we have increased to fifty billions today with an increase in consumption from 60 to 500 kw. hours per capita. It is a magnificent achievement of the initiative and ingenuity of these industries, and that it has attained such a growth under public regulation is itself proof of the ability and cooperation of our public officials. I believe that the same vision applied to the wider problems which spread before us will maintain the same initiative and secure like progress in the future.

Extract from Statement of Secretary Hoover at Conference of Public Service Commissioners to Consider Superpower Development in Northeastern Section

State Responsibility in Water Power Development

By O. C. Merrill

Executive Secretary Federal Power Commission

An Engineer's Estimate of Why Some Appliances Are Not in Use

By E. S. Lincoln

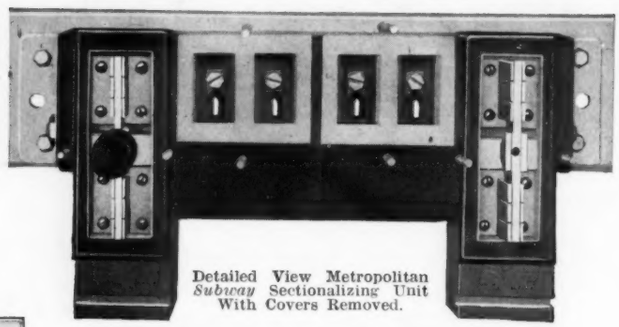
Digest of the World's Electrical Literature

The Week's News and Review of Business Conditions

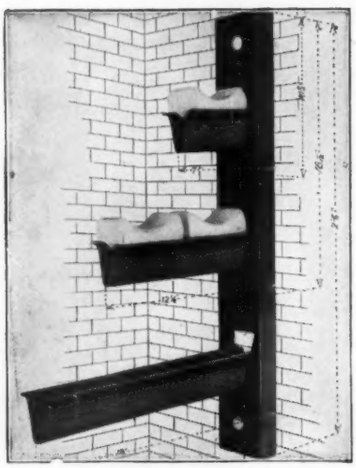
Construction News

Electrical Patents

Monthly Research Section



Detailed View Metropolitan *Subway* Sectionalizing Unit With Covers Removed.



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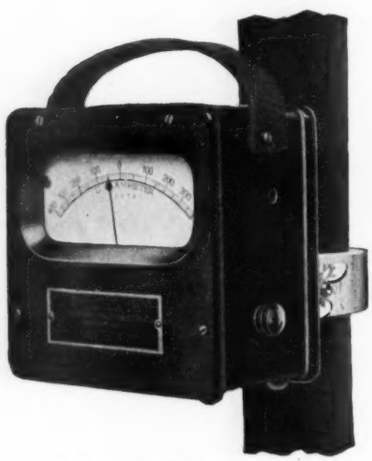
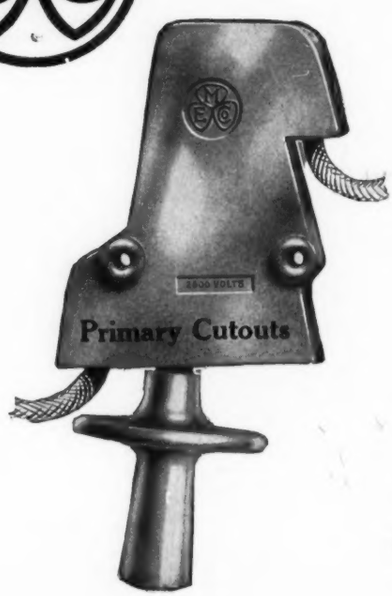
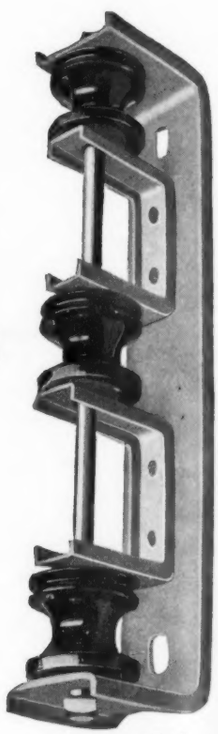


D. C. Cable Testing Ammeter with laminated loop





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Electrical World

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Support Action with Action

TWO years ago last summer the Superpower Survey of the Northeast Atlantic Seaboard made its report. "Superpower" as a word, as an idea, as an inspiration, was widely heralded to the public. No particular conception of it registered, except a vague idea of the development of mammoth power stations and transmission lines and an era of more and cheaper electricity.

Meanwhile, the electrical industry has gone its way, steadily if slowly, making an interconnection here, building a huge station there, always with the ultimate aim in view, though in a hazy future. In other parts of the United States interconnection on an extensive scale has progressed more rapidly. But in all cases the public has failed to be impressed with the fact that it was experiencing a "superpower" development—and, as a matter of fact, the electrical industry itself knows that it is far from a complete accomplishment of what is practicable, feasible and highly desirable from an engineering and economic point of view.

HERBERT HOOVER, with characteristic directness and perception, has started to pave the way toward a consummation of many of these superpower plans for the Northeastern States which are known to be practicable and desirable. Recognizing that widespread reciprocal interconnection and a comprehensive development of water power can never be realized until the various states in the region can agree upon a program of co-operation in encouraging the development, he has appealed directly to that group of public representatives most intimately familiar with the situation and its problems to start something that will result in action. Some move had to be made. Secretary Hoover had the courage and foresight to take the initiative. Particularly in the region under discussion will superpower development be an aid to industry—which, of course, is the aim of the Department of Commerce under its present Secretary. Fortunately and wisely he has emphasized the fact that this whole plan has no element of politics in it, but is solely a matter for engineering, business and economic consideration.

IT IS extremely important that utilities co-operate in the work the Secretary has started not only with full sympathy but also with real constructive action. Mr. Hoover pointed out, and his conference with the commissioners further emphasized, that a common or uniform program of permissive legislation, or at least of non-inhibitory legislation, must be inaugurated by the various states. But he pointed out, too, that the utilities must also co-operate in working out the necessary intercorporate financial, legal, engineering and commercial problems necessary to a full consummation of the general plan.

The public vaguely wants "superpower." It wants hydro-electric development. It wants electrified industry. It wants electrified homes. Moreover, it wants to obtain all this as quickly and as economically as possible. The idea is practicable, as the electrical industry itself is fully aware and has announced. The promise has been held out and it is now time for action. The states concerned must act, the utilities must act, and it is not only an encouragement but a very practical move toward accomplishment that Secretary Hoover himself has acted and set up a program of definite constructive purpose.

Arthur B. West

A central-station executive who has exerted a tremendous influence in the economic development by hydro-electric power of southeastern California.

THE story of the part that hydro-electric power has played in the economic development of the great Imperial Valley, the citrus-fruit belt of southern California and the mining district of western Nevada and southeastern California is really the story of the career of Arthur B. West, president and general manager of the Southern Sierras Power Company. Born in Rochelle, Ill., in April, 1877, Mr. West was graduated from Stanford University in 1899, remaining there for two years for a post-graduate study of law. In 1906 he became junior member of the law firm of Potter & West, counsel for the Nevada-California Power Company at Denver. Thenceforth he was to become more and more closely identified with hydro-electric development on the Pacific Coast.

Back in the days of the Goldfield and Tonopah mining discoveries in Nevada, a group of Denver capitalists developed hydro-electric power on Bishop Creek in northwestern Inyo County to supply the urgent needs of the gold and silver camps across the Nevada line. This company, known as the Nevada-California Power Company, carried its line across the barren White Mountains at an altitude of 10,000 ft. and over other intervening ranges to the camps, mines and mills of the new Golconda which had grown up over night amid the sage brush and cacti. Seeking new and permanent markets for the power that could be developed on Bishop Creek and other streams in the vicinity, it was decided to extend the line south a distance of 239 miles, across the Mojave desert and over the San Bernardino range, to the prosperous citrus and agricultural districts of Riverside and San Bernardino Counties and to the Imperial Valley.

The project involved transmission of power over an unheard-of distance at twice the next highest voltage then known in California. The Southern Sierras Power Company was organized and the line built during 1911 and 1912. This line stands today as the world's longest transmission line—537 miles. At this time Mr. West was called from the legal to the executive branch of the business to become vice-president and assistant to President Delos A. Chappell. On Mr. Chappell's death, in 1916, Mr. West was made first vice-president and general manager, and since early this year he has been president and general manager. In addition he is general manager of the Nevada-California Power Company and the Holton Power Company, both subsidiaries of the Southern Sierras Power Company. He is an active and vigorous force in economic, civic and social betterment.

Editorial Comment

Electrical World, October 20, 1923

Volume 82 Number 16

Light as a Safeguard

CASUALTY statistics for many years were full of records concerning industrial accidents, machine-butchered hands and arms and feet, cuts and bruises from tools, broken limbs and heads from falls, and similar unpleasant items in the day's work. Fortunately the safety campaigns of various agencies, including notably the National Safety Council, have done much to reduce the number of such injuries. But they are still too many.

It is somewhat surprising that more emphasis has not been placed upon light as a most effective agency in the reduction of industrial accidents. The experimental proof of the increased accuracy and speed of vision with increased intensity of illumination points directly and with emphasis to the increase of lighting facilities as a safety measure. For when a man sees danger clearly and quickly he seldom intentionally walks into it.

There are few mechanical guards so effective for safety as good light. And, what is of further real value, light is the only guard which at the same time increases the efficiency of the workman.

The Antics of Modern Physical Theory

WHY should the exponent of the distance in the inverse-square law be exactly "two"? Thoughtful students of nature's laws have often wondered at their simplicity and have seen in this very simplicity the probability of their ultimate explanation in terms of some deeper fundamental phenomena. Careful electrostatic measurements have determined that the exponent "two" for electric forces is accurate to within one part in forty thousand, and for years there has been a general acceptance of the exact inverse-square relation between electric force and distance.

But the discovery of the electron and the study of its relation to the positive nucleus of the atom have shown clearly that the inverse-square law cannot hold for the minute distances involved in the dimensions of the atom. Some other law must obtain, if the forces within the atom are all electrical, as seems certain, and if the law is to explain even the most ordinary facts of chemistry and physics. And, strange to say, the new law must provide a change from attraction to repulsion between opposite charges as the minute distances between these minute charges vary. How then can there be a law involving an accurate inverse square of the distance for all direct tests of the law and which must yet be abandoned or changed when we descend to atomic dimensions? The answer is simple. The law is expressed by a series of terms having different exponents of the inverse distance. For ordinary distances within man's recognition the inverse-square relation far outweighs all the other terms, but for the minute distances between electrons within the atom other terms become preponderating, so that the actual relation of electric force and distance between charges passes through a process of change which reverses the direction of the force for the smallest distances. By assuming a law of force of this character Sir. J. J. Thomson has been able to explain on electrical grounds a large number of chemical and physical phenomena hitherto unrelated and obscure.

Another curious product of modern physics is the so called "quantum" hypothesis by which electrical radiation, generally supposed throughout the whole history of physics to be a continuous or uniform phenomenon, in reality takes place by pulses. These pulses are due to the shifting of electrons from one orbit of equilibrium to another within the atom. Apparently there are a series of concentric orbits about the central positive nucleus, in any one of which a number of electrons can be in equilibrium. But if by the collision of two atoms, or by radioactive or other stimulus, an electron is knocked out of one orbit, it immediately pitches into some other one, and this plunge from one orbit to another gives out by radiation a "quantum" of energy. This quantum is found to be a constant over a wide range of radiation phenomena. The question of the universal periodic property of radiated energy is as yet not completely explained, but the fundamental fact of energy pulses of definite amount as the basis of electromagnetic radiation seems to be established beyond doubt.

The Water-Power Situation in New York State

STRONG opposition to the constitutional amendment permitting the erection either by the state itself or by private promoters of electric power houses and transmission lines in the New York State Forest Preserve in the Adirondack district has manifested itself in that commonwealth, and the voters are being called upon both by a Committee to Prevent the Exploitation of the Adirondacks and by Governor Smith to defeat the proposed change in the fundamental law. The opposing arguments take two forms—one that the amendment would permit virtual private ownership in the form of fifty-year leases of the state's potential water powers without provision for due compensation to the people and that these water powers should continue to be vested absolutely in the state and any development of them made and operated by the government; the other that the amendment would lead to a destructive raid on the mountain parks by timber and power companies, defacing scenery, destroying forests and creating "highly artificial, unsightly and dangerous conditions." The opponents of the amendment also point to the way in which it was twice rushed through the Legislature in its closing hours as an

indication to their minds of something sinister and underhand in the whole proceedings.

On the other hand, the advocates of the amendment, denying the truth of such statements and insinuations, lay stress upon the crying need of more electrical energy for the industries and homes of the state, some claiming that a million horsepower—a metropolitan journal enlisted in their support makes it a hundred million!—can be made available on the adoption of the measure by the utilization of less than 2,500 acres out of 6,000,000, though the proposed amendment would permit up to 3 per cent of the preserves to be taken, or 180,000 acres. It is also pointed out that a short route would be furnished for transmitting power from the St. Lawrence River through the mountains to lower New York. According to these defenders, who number among them men of standing in public life as well as some prominent in electrical circles, the constitutional amendment is unequivocally in the public interest and its leading antagonists are a "small group of wealthy owners of private estates and preserves."

Thus there are presented the same conflicting points of view that are sure to be confronted whenever in any part of the country a question of the development of water power on public and scenic lands comes up. The voters, awake to the advantages of electricity both to turn the wheels of industry and to lighten household tasks and enhance domestic comfort, are at the same time jealous of private exploitation of public resources. To them from divers sources comes conflicting counsel. Public utilities in esse and in posse are eager to serve them, but naturally on the condition that the utilities themselves shall gain a reasonable profit on their investment and their enterprise. Devotees of public ownership, on the other hand, would cheerfully pile up a great public debt, as has been done just across Lake Ontario, to permit the retailing of electricity at a low price by the state. Tourists, campers, artists and nature lovers, whose motives are worthy of all respect, preach preservation as a matter of esthetic duty, putting beauty so far above utility that sometimes a single scar on the scenery outweighs in their minds the thought of vast material development. Proprietors of delightful estates—a very small fraction of the population—anxious lest their surroundings be marred by the despoiler, join the outcry—and finance it. On both sides of the question, too, are undoubtedly conscientious political leaders and representatives, as well as others swayed by interested or partisan motives. Sometimes the citizen finds it difficult clearly to distinguish between the two classes.

To steer a straight course through these cross-buffeting waves and against these contrary breezes, the electric light and power industry must study the situation impartially and unselfishly. Its is the responsibility for an adequate electrical development and service for any community. Sorely as it is needed, it would be better for water-power development in any state to be delayed than for it to be promoted with any suspicion of subterfuge or under enactments imperfectly protecting the state from possible injury and loss. The contradictory statements about the objects and the implications of the Ferris amendment need clearing up, and the electrical industry should be the first to insist upon this clarification. So far, in New York, the central-station companies with few exceptions have made no aggressive move either to learn or to tell what it is all about. Doubtless any clarification they may make will show definitely to the people that the proposed amendment is in public interest and should be supported. If the amendment shall be carried next month, the legislative enactments that will make it operative and the executive machinery set up to enforce it should embody that wise middle course between unbridled private responsibility and unduly obstructive legislation that nine times in ten is the best political wisdom. In the contest that will ensue between the respective advocates of public and of private development the latter could disarm suspicion only by making it as clear as day that they did not desire to capitalize "unearned increments" and were prepared to submit to all proper regulation. If the amendment shall be defeated, before another one is submitted to the people the matters in dispute should be thoroughly thrashed out at public hearings. The whole water-power situation in New York State, which has so important a bearing on interstate networks and nation-wide superpower, needs to be put on a stable and permanent foundation such as, after years of effort, was provided as regards our national parks and our navigable streams by the creation of the Federal Power Commission.

Building Distribution Systems with Prophetic Vision

NOT many years ago central-station business consisted largely of residence and street lighting. Possibly some industrial load was carried, but this was usually in a confined area served very readily by primary service at about 2,300 volts. Today all that is changed, and more and more it becomes evident that the conditions now affecting distribution of energy in large metropolitan areas cause much difficulty in rendering adequate service at an economical rate. One factor in this problem is the widely scattered and more numerous power customers served and another is the increase in both amount and density of both power and lighting load in the more congested districts.

The trend is toward more substations and higher distribution voltages as the way to meet the situation, but a rather chaotic situation is coming about on many systems as a result of somewhat haphazard methods. Some are finding that changing old circuits to three-phase, four-wire is merely a stop gap in the search for a means of getting greater capacity in the distribution system. Others attempt power distribution at voltages around 13,000 for power customers and a second lighting distribution based on three-phase, four-wire circuits. Still other combinations are found involving small automatic alternating-current substations, network transformer operation or a multiplicity of substations. Regulation methods are debated, and there are varying practices of regulation from substations, regulation at the pole, regulation on the customers' premises and separate regulation of residence circuits and power circuits. Some distribution lines have high-voltage and low-voltage power circuits, high-voltage and low-voltage residence lighting circuits, and in addition street-lighting circuits, all on the same poles. And even the practice of serving power customers is very much a matter of individual opinion and experience on the various properties, while power-factor corrective practice is still more individualistic in character.

Such a situation affords a fine opportunity for real engineering and economic analyses, but care must be exercised to make sure that all elements are considered. For example, the item of commercial rates is a very important factor. The customer may or may not purchase high-voltage service and equipment instead of low-voltage service and equipment, his decision depending upon rate differentials. Moreover, the amount of equipment or supervision afforded the customer for each class of service has an important bearing on the problem. Needless to say, the question of power factor largely reduces to a rate question, while local conditions greatly modify any general conclusions.

But, even though the problem introduces many more variables than those involved in the application of Kelvin's law or voltage drops, there is no real obstacle to a basic solution for both overhead and underground systems. It is certain that many properties would avoid unnecessary expenditures if such analyses were made from a perspective embracing all present elements and careful predictions of future conditions. It is also certain that the engineering forces of the various companies can never give really adequate attention to the problem unless and until company executives realize that it involves major financial expenditures, that it contains serious elements of future obsolescence if wrongly handled and that it directly affects the service rendered.

Co-operation Needed to Run Down Small Defects in Electrical Appliances

TO KEEP electrical appliances in use central-station companies have quite generally adopted a liberal policy of service and repair. In a measure this has retarded the elimination of many little imperfections of design and construction. Most appliance troubles can be remedied by a minor adjustment or repair, and usually it has been only in the case of an actually defective part that the manufacturer has been called upon to replace it. In E. S. Lincoln's analysis of the situation, on page 807, he emphasizes the fact that nearly all failures of electrical appliances are caused not so much by glaring faults in design or construction as by comparatively insignificant details. Yet from the standpoint of the customer the cause is not so important as the effect.

Actual use of the appliance in the customer's home is the only way that these small defects can be searched out and remedied. The faults could be corrected by the manufacturer with a little strengthening here and there or a slight change in design or construction. But in most cases the manufacturer does not learn of these troubles because the central-station company's service department makes the repair and forgets it, and so it goes on—the same weakness causing new trouble until the user lays aside the device or tries some other make, unless the central station continues to carry the maintenance burden.

The perfection of the automobile has been made possible only by the close watch which the manufacturer has maintained on cars in use. Year by year defects have been detected and eliminated. So it should be with electrical appliances. A little closer co-operation between the manufacturer and the retailer in searching out and correcting these small deficiencies that Mr. Lincoln talks about will materially reduce the amount of servicing now necessary and also raise the reputation of the electric device as a rugged and serviceable piece of apparatus which can be depended upon.

Local Trade Relations and the Contractors' Convention

THE annual convention of the contractor-dealers last week contributed further evidence of the increasing interest taken by electrical men in each other. John F. Gilchrist and Miss S. M. Sheridan, central-station vice-presidents from Chicago and Detroit, addressed the meeting, and there were a number of other utility men present. Through the addresses and the discussions also ran a note that seemed to show a recognition of the interdependence between the members of the local electrical family, particularly the need for common policies that will mutually protect and profit the contractor-dealer and the central-station company.

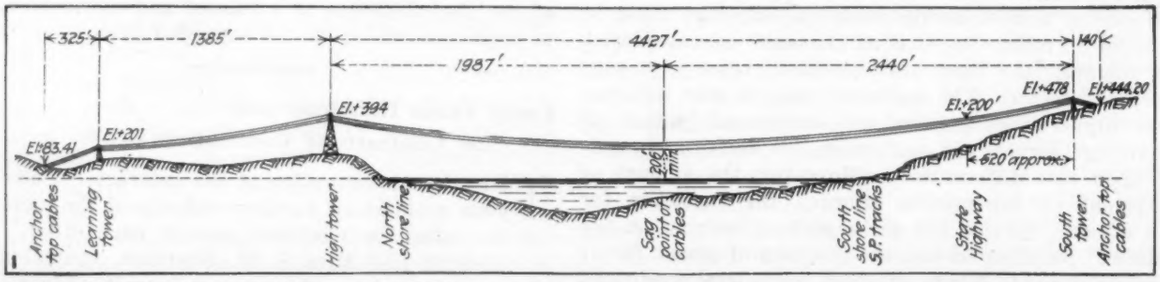
There was a time, not so long ago, when this spirit was not so conspicious in meetings of either group. Lack of local understanding was reflected in national gatherings and tinctured national plans. There was a subconscious attitude of belligerence between the two camps, because each felt that the other was antagonistic. Happily today the industry, bit by bit, is working out of this dank atmosphere into the sunshine of better feeling, as the men of each group are appreciating more fully that the greatest issue that confronts them all is the job of market development, and that in this work there is a common vital interest, an actual unity of purpose. The problem of local trade relations, the question of how to develop harmony among all the electrical men of each community, is steadily coming to the fore.

Laboring Under a "Technical" Handicap

TOO many people still picture the engineer in industry as a narrow technician who attacks every problem with a slide rule and an array of mathematical formulas. They grant him theoretical technical competency, but completely fail to visualize the type of engineer that is now in the majority—the operating manager of great physical properties involving the correct application of technical knowledge, business judgment and psychology. He seldom if ever uses a slide rule or a mathematical expression or indulges in fanciful theoretical analyses. Rather he busies himself with operating, directing and building a vast organism having facets reflecting every type and kind of human and mechanistic activity.

This type of engineer is really handicapped by the label "technical" and the name "engineer" when he encounters the general business or professional man on a plane which should merit recognition of his real place in industry. It is unfortunate that, unlike doctors, engineers have not carried their specialization to the point where a qualifying adjective illumines the general professional term.

Continuous and active work is needed throughout the country to convince the general public that all engineers are not alike and that a large number merit the title of big business men whose opinions on broad economic and social questions are predicated on a knowledge and an experience comparable to that of any banker, lawyer or executive.



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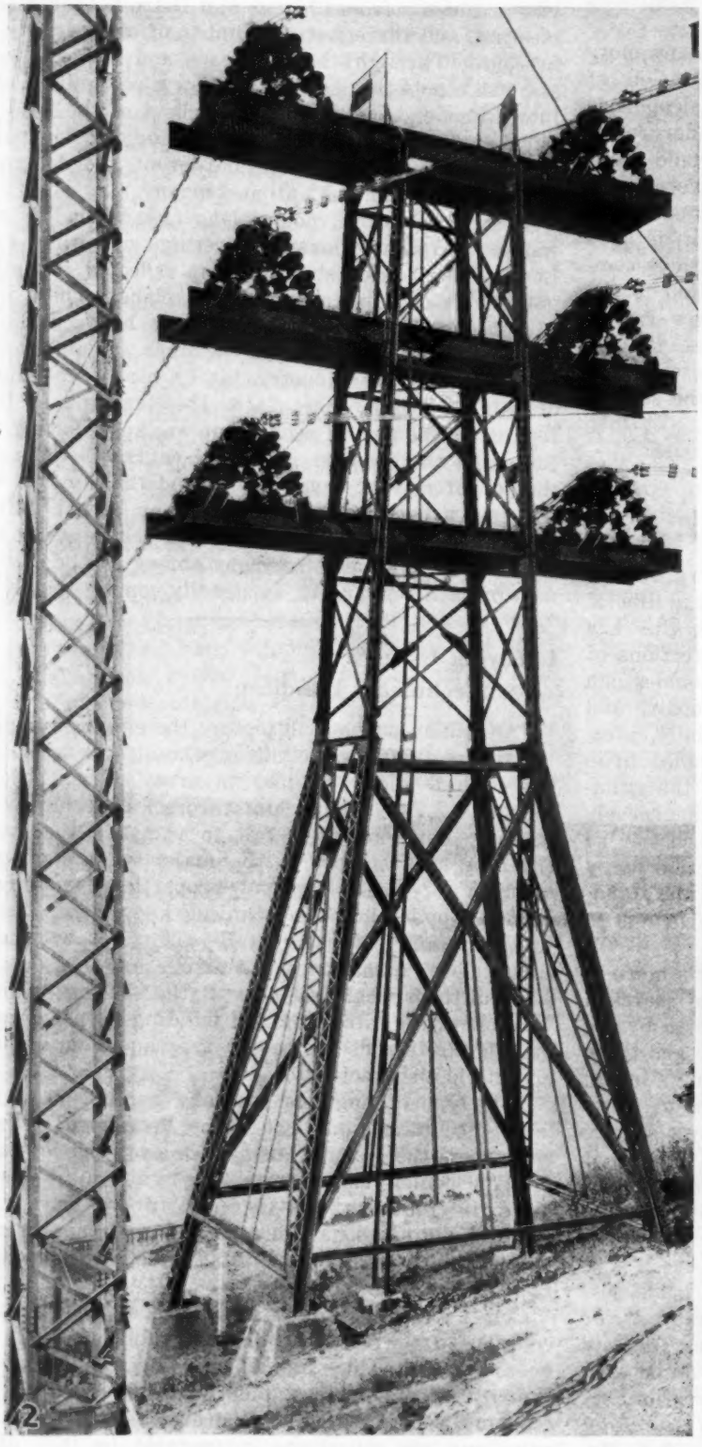

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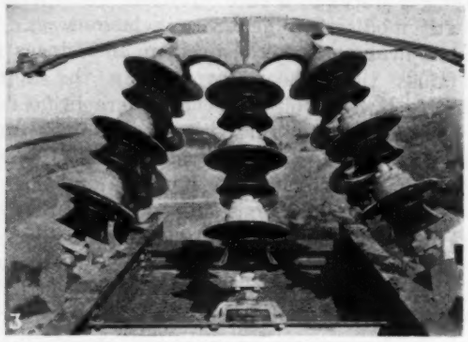

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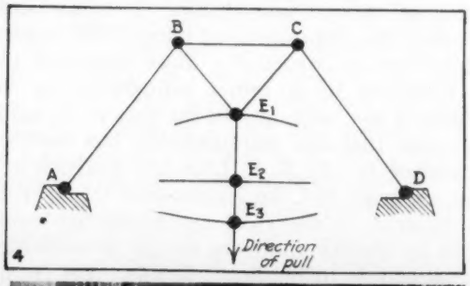
Design of 4,427-Ft. Span Over Carquinez Strait

A TWO-CIRCUIT 110,000-volt waterway crossing installation using insulating materials in compression is the unusual feature of the 4,427-ft. span across Carquinez Strait. An axle and sheave five-hinged anchor arrangement cares for unequal expansions with levers and pillars arranged to produce compression stresses only on the insulators. Hinges *B*, *C* and E_1 are free to shift, while *A* and *D* are fixed. The cable is attached at E_3.



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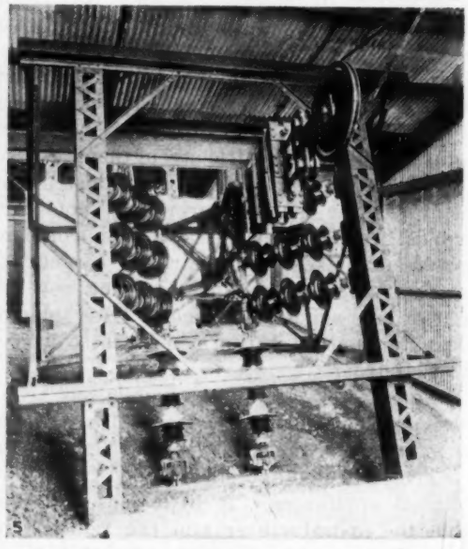

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Del Monte A. I. E. E. Convention

Papers on Research, High-Voltage Equipment and Transmission, Waterwheel Problems and Carrier Radio Are Presented in a Symposium Form—Inspection Trips Prove a Drawing Feature

THE 1923 Pacific Coast convention of the American Institute of Electrical Engineers was held at the Del Monte Hotel, Del Monte, Cal., on Oct. 2 to 5 inclusive. The attendance was unusually good, the average at each of the sessions being in excess of 150 and the registration reaching 233. Thirty papers were presented during the three morning sessions and one afternoon session.

These papers covered a range of subjects from research to the design and operation of high-voltage transmission lines; practice concerning high-voltage switches, bushings, lightning arresters and busbars; waterwheel construction, operation and governing; carrier-current radio as applied to transmission lines, and telephone transmission over long distances.

Two inspection trips over the week end proved a drawing feature. One was to a large hydro-electric development in the High Sierras, the other to important substations in the San Francisco Bay region.

Investigation of Corona Loss

The opening session of the convention was presided over by Robert Sibley, convention chairman, who introduced Harris J. Ryan, president of the Institute. Following a brief address Professor Ryan presented his paper on "Researches Relating to High-Voltage Transmission." One of the purposes of the investigation and experiments which are being conducted, Professor Ryan said, is to determine the nature of corona and the laws which govern it. The experiments which are being conducted have been much facilitated by the development of a cathode-ray tube which will operate on moderate voltages. The boundary of the rectangular cathode-ray card is a measure of the corona loss.

Dr. Steinmetz in discussing this paper said that he considered the problem of insulation—the destruction of insulation—to be the most important one before electrical engineers today. "We are not up to the height of knowledge on this subject that we are in nearly every other field," he asserted. "We have so little knowledge to work with—so many factors which must be approximated—that we must have large factors of safety."

Transmission Line Practices on the Coast

Factors Affecting Electrical and Mechanical Construction of Transmission Lines Discussed—Snow and Ice a Source of Trouble in Many Regions

SEVERAL good papers were presented covering transmission-line construction and design as practiced by Pacific Coast engineers. W. Dryer of the Pacific Gas & Electric Company covered the practices of that company in his paper. He stated that design factors could be divided into two groups on the basis of those that affect the shape or the strength of the supporting structure. Factors affecting shape were listed as inside sag, clearance of phases and circuits, length and deflection of insulator string, type of tower and the clearance between conductors and tower members. Under those factors affecting strength are size and stress of conductor span and type of tower. Tests of the company showed 17,000 lb. per square inch for copper ranging from 250,000 circ.mil to 500,000 circ.mil to be the best value.

It is customary to consider more broken wires for double-circuit than for single-circuit towers. It is the practice of the company to assume three broken wires on standard double-circuit towers, all wires being on one side of the tower. This case will usually occur when the top wire breaks and drops across the two lower wires. Two wires are assumed broken with standard single-circuit towers.

Dead-end towers are designed to resist all wires broken at maximum stress in the conductor. This would occur under the condition of heaviest loading and with dead-end insulator strings.

For standard towers (designed for two or three wires broken) and for anchor towers (designed for all wires broken) no dead-end construction is permitted, the insulator string being suspended vertically. In this case when a wire breaks the insulator strings swing into the catenary, increase its length and therefore greatly reduce the tension in the span adjacent to the break. For standard 110-kv. double-circuit lines the resultant stress is 78 per cent, and for the 220-kv. double-circuit line it is 66 per cent of the maximum conductor stress. All towers of the Pacific Gas & Electric Company are tested to 50 per cent overload.

Transpositions on the 110-kv. lines are of the conventional "dead-end and jumper" type. Transpositions on the 220-kv. Pit River line are of the "rolling type"; that is, the wires are transposed without dead-ends or jumpers. The crossing wire of each circuit is pulled out of the vertical plane to an insulator suspended from the bridge, and the transposition is completed in two spans. The single-circuit transposition requires three spans for completion.

Where twin-tower lines traverse country that is not flat it is impossible to set the structures directly opposite each other. The amount of offset that will be permitted should be based on maintaining a minimum clearance between adjacent wires equal to the distance between phases on the flat-top, single-circuit towers. The horizontal projection of the catenary as deflected by wind furnishes the basis for the determination of allowable stagger. In designing the towers clearances are investigated under the assumption that the insulators are permitted to swing transversely to the line at some angle (usually between 30 deg. and 45 deg.) from the vertical.

Oak Grove Transmission Line

The Oak Grove transmission line of the Portland Railway, Light & Power Company was described by H. R. Wakeman and W. H. Lines. The line is 110 kv. and 54 miles in length. In the design of the line factors considered were voltage, conductor size and tension, loading, type of supporting structures and physical character of the country.

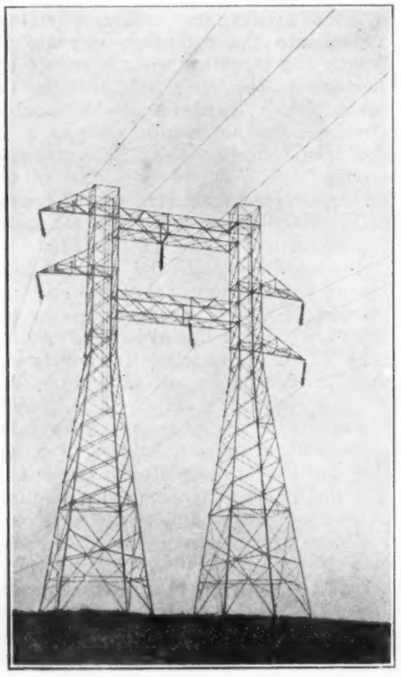
It was determined that for the ultimate development of 90,000 kva. two circuits each of 250,000-circ.mil hard-drawn, stranded copper, at 110 kv. grounded neutral, embodied respectively the economic number, size and voltage to employ.

The limitations imposed by the mechanical strength of available insulators and hardware were a considerable factor in the decision to use 4,000-lb. maximum conductor tension, equivalent to a stress of 20,000 lb. per square inch, or one-third of the ultimate strength of the conductors in this line.

After an investigation of the possible sleet, snow and wind conditions in the

country traversed, it was determined to use class B loading, namely, a maximum conductor tension equivalent to the load of the conductors plus ½ in. of ice and 8 lb. per square foot wind pressure on the ice-coated conductors at a temperature of 0 deg. F.

There were placed on the profile, to scale and by means of properly constructed sag templates, four types of



220,000-VOLT DOUBLE-CIRCUIT TRANSPOSITION TOWER OF PACIFIC GAS & ELECTRIC COMPANY

supporting structures designed for the assumed loading conditions and appropriate for the physical topography of the country. It was found that the maximum sag occurred on the line under summer loading conditions, at a temperature of 120 deg. F. The following are the four types of supporting structures which were considered:

1. Single wooden poles, average spans 300 ft., single-circuit capacity.

LOADING CONDITIONS ASSUMED FOR THREE TYPES OF OAK GROVE TOWERS

Loading Conditions	Type A	Type B	Type C
Number of conductors assumed broken	3	6	6
Maximum horizontal curve	10 deg.	30 deg.	60 deg.
Maximum span length when combined with curve	500	800	800
Vertical load—dead weights of conductor	6 at 1,800 lb.	6 at 1,200 lb.	6 at 1,200 lb.
Horizontal load in line component of conductor tension	3 at 4,000 lb.	6 at 3,500 lb.	6 at 5,200 lb.
Horizontal load across line component of conductor tension plus wind on conductor	6 at 1,400 lb.	6 at 2,200 lb.	6 at 3,700 lb.
Horizontal load across line, wind on tower	1 at 1,600 lb.	1 at 1,600 lb.	1 at 1,600 lb.
	32,800 lb.	43,000 lb.	62,000 lb.

The type A tower on tangents will accommodate spans to 800 ft.
The type B tower on tangents will accommodate spans to 2,400 ft.

PHYSICAL DIMENSIONS OF TOWERS

	Type A	Type B	Type C
Cage	4 ft. 6 in.	4 ft. 6 in.	4 ft. 6 in.
Length of cross-arm, cage to insulator support	7 ft. 0 in. and 9 ft. 0 in.	7 ft. 3 in. and 9 ft. 3 in.	7 ft. 3 in. and 9 ft. 3 in.
Horizontal separation of conductor at supports	18 ft. 6 in. and 22 ft. 6 in.	18 ft. 9 in. and 22 ft. 9 in.	18 ft. 9 in. and 22 ft. 9 in.
Vertical separation of conductor at supports	10 ft.	10 ft.	10 ft.
Height of lowest arm above ground	48 ft.	48 ft.	45 ft.
Over-all height above ground	72 ft.	72 ft.	69 ft.
Weight of tower exclusive of extension and footings	4,325 lb.	5,355 lb.	5,635 lb.
Weight of footings (all steel)	550 lb	1,820 lb.	2,780 lb.
Depth of footings in ground	7 ft. 6 in.	6 ft. 6 in.	7 ft. 6 in.
Area of footing at bottom	3 ft. x 3 ft.	4 ft. 8 in. x 4 ft. 8 in.	5 ft. 6 in. x 5 ft. 6 in.

2. Double wooden poles (H frames), average spans 450 ft., single-circuit capacity.

3. Light steel towers (combination of flexible frames and anchor towers), average spans 500 ft., double-circuit capacity.

4. Heavy rigid towers, average spans 700 ft., double-circuit capacity.

Detailed estimates of material and labor were then prepared for each of the four types, and these resulted in favor of the fourth, namely, heavy rigid towers, average spans 700 ft.

From a study of the loading conditions imposed on the towers by the varying span lengths and the horizontal and vertical curves it was decided to provide three types of towers to meet all these loading conditions, as follows:

Type A Towers.—To be used on tangents up to 800-ft. spans, also on curves up to 10 deg. with spans not exceeding 500 ft.; suspension insulators to be used.

Type B Towers.—To be used on tangents up to 1,700-ft. spans, also on curves from 8 deg. to 30 deg. with spans not exceeding 800 ft. for the larger curves; suspension insulators to be used.

Type C Towers.—To be used at dead-ends and curves over 30 deg.

The towers were designed to withstand maximum loading conditions embraced in each of the above classes, plus 50 per cent as an assumed margin of safety, without exceeding the elastic limit of the steel.

The design of the towers was also checked for maximum possible torsional load, namely, with three conductors broken on one side of the cage.

Special steel having a guaranteed elastic limit of 45,000 lb. per square inch and a minimum elongation of 22 per cent was used in the towers. Actual tests of samples which were taken from the tower stock showed yield points from 48,000 lb. to 53,000 lb. per square inch.

Insulators are attached to cross-arms by means of forged steel hooks with an elastic limit of 6,000 lb. It was thought best to limit the strength of this connecting member so that if any load greater than the assumed came on the conductors, the connection would fail rather than the tower.

LAGUNA BELL 220-KV. LINE

The transmission line from Laguna Bell substation to Eagle Rock substation of the Southern California Edison

DATA ON STANDARD TOWERS OF PACIFIC GAS & ELECTRIC COMPANY

	220-Kv. Tower Lines				110-Kv. Tower Lines			
	Single-Circuit Towers		Double-Circuit Towers		Single-Circuit Towers	Double-Circuit Towers		
Item	Type SA	Type SC	Type M	Type 0-98	Type S	Type AH	Type BH	Type CH
Height:								
Over all	55½ ft.	55½ ft.	97 ft.	98 ft.	49½ ft.	83 ft.	83 ft.	83 ft.
To lower cross-arm	51½ ft.	51½ ft.	62 ft.	63 ft.	48 ft.	58 ft.	58 ft.	58 ft.
Width:								
At base	20 ft. x 20 ft.	20 ft. x 20 ft.	20 ft.	20 ft.	14 ft. x 14 ft.	16 ft.	16 ft.	20 ft.
At cross-arm	4 ft. x 20 ft.	4 ft. x 20 ft.	6 ft.	6 ft.	2 ft. x 14 ft.	4½ ft.	4½ ft.	4½ ft.
Conductor separation:								
Between phases	19 ft.	19 ft.	15 ft.	15 ft.	13½ ft.	10 ft.	10 ft.	10 ft.
Between circuits	.....	.....	24 ft.	24 ft.	.....	17½ ft.	17½ ft.	17½ ft.
Conductor:								
Maximum size (copper)	500,000 circ.mil	500,000 circ.mil	500,000 circ.mil	500,000 circ.mil	3–0	250,000 circ.mil	250,000 circ.mil	250,000 circ.mil
Loading	8 lb. wind ½-in. ice	8 lb. wind ½-in. ice	8 lb. wind no ice	8 lb. wind no ice	6 lb. wind 1½-in. snow	8 lb. wind no ice	8 lb. wind no ice	8 lb. wind no ice
Number broken	3	3	3	6	2	3	3	6
Span:								
Normal	500	500	800	800	400	800	800	800
With angles	....	1,000	....	800	....	....	800	800
Maximum on tangents	750	1,500	1,000	1,800	400	1,000	2,000	2,500
Maximum contributing weight	1,500	2,100	1,050	1,800	400	2,000	2,500	5,600
Maximum angle	None	22½ deg.	None	22½ deg.	None	None	15 deg.	45 deg.
Type of conductor support	Suspension	D. E. or susp.	Susp.	D. E. or susp.	D. E. or susp.	Susp.	D. E. or susp.	D. E. or susp.
Weight of tower	5,100 lb.	7,270 lb.	8,440 lb.	12,950 lb.	4,250 lb.	5,080 lb.	6,200 lb.	7,590 lb.
Foundations:								
Concrete	6.28 cu.yd.	11.8 cu.yd.	7.8 cu.yd.	15.2 cu.yd.	11.2 cu.yd.	6.72 cu.yd.	8.72 cu.yd.	12.9 cu.yd.
Excavation	18.1 cu.yd.	60.4 cu.yd.	25.5 cu.yd.	84.5 cu.yd.	32.5 cu.yd.	22.4 cu.yd.	31.2 cu.yd.	44.4 cu.yd.

Company was described by C. B. Carlson and W. R. Battey.

The design was started following a request from a committee assigned to investigate the electrical features of a line of this voltage. The questionnaire outlined investigation on the use of the following five sizes of conductors: 605,000-cir.mil steel-reinforced aluminum cable, 1,000,000-circ.mil steel-reinforced aluminum cable, 1,500,000-circ.-mil steel-reinforced aluminum cable, copper cables of equal conductivity to the last two sizes.

The first preliminary study eliminated from consideration the majority of the materials and limitations, and further study was requested on the use of cables of 666,600-circ.mil steel-reinforced aluminum, made up of seven strands of extra-high-strength steel and fifty-four strands of aluminum and having the following characteristics:

Diameter, 1 in.; ultimate tension, 24,430 lb.; elastic limit, 16,180 lb.; area, 0.59 sq.in.; weight, 0.86 lb. per foot. Analysis showed the most economical span to be between 1,150 ft. and 1,300 ft. and a 1,250-ft. span was selected. Tower designs were then based on 12,000-lb. cable tension, 6-ft. clearance, thirteen 10-in. disk insulators, with fifteen double-string on dead ends, aluminum shield rings, 10 deg. temperature range, 30 ft. ground clearance at 120 deg. F., and a wind pressure of 10 lb. per square foot on one and a half times the area of one face of tower and of 8 lb. on the projected area of conductor.

The committee having the features of the design of this line in hand required a factor of safety of three in the strength of the attachments of the cable to the towers. Owing to limitations of clearances this required the hardware to be made of cast steel. All hardware was designed and tested for loads three times the maximum tension.

The towers, except those in rather inaccessible places, which were assembled piece by piece, were erected by assembling the tower on the ground in two parts, dividing the face normal to the line and bolting with loose bolts each leg to the footing studs. Then, by means of two gin poles set aside the footings and a winch set on a truck and operated by its motor, the two halves were raised and connection made at the center gusset plates. The bridge of the tower was then hoisted in place.

The line stringing was also done by the use of the motor-operated winch.

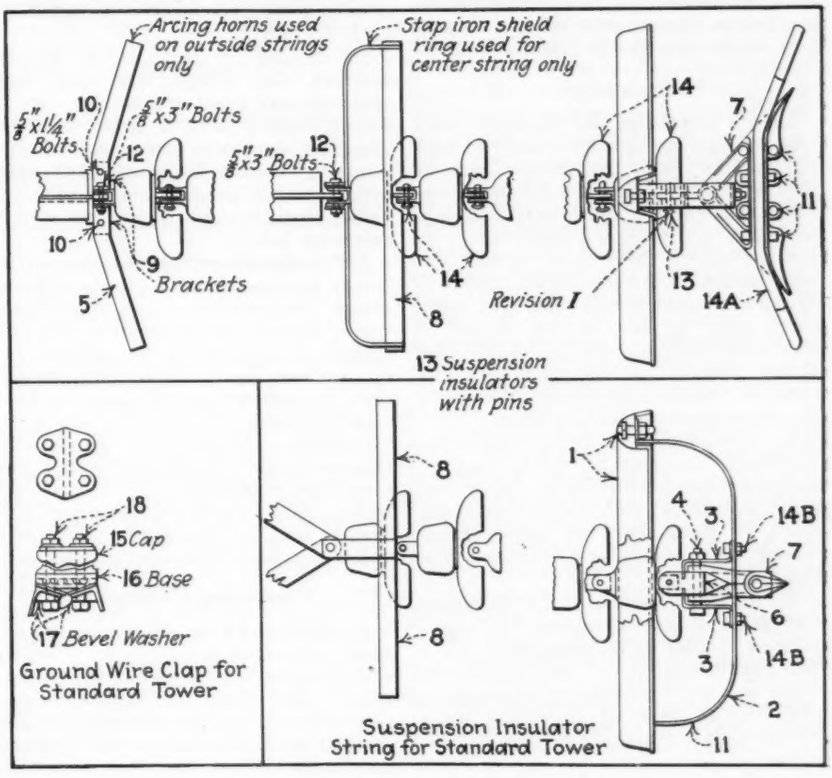
Mountain Construction Practice

M. T. Crawford described a recent extension of the Puget Sound Power & Light Company consisting of a 120-mile, 110-kv. transmission line from the White River generating station to Wenatchee, Wash.

On account of the heavy snows and inaccessibility of sections of the line over the two mountain ranges additional mechanical strength was provided where the elevation exceeded 3,000 ft. Type SA 55-ft. steel towers were used for line supports, No. 4/0 B. & S. hard-drawn seven-strand copper cables for conductors, with O. B. No. 25620 cap-and-pin-type insulators, six-unit strings in suspension and seven-unit strings in strain. Spans were normally from 400 ft. to 700 ft., with conductors pulled to a tension which would stress the wire to its elastic limit of 4250 lb. at 0 deg. F., 8-lb. wind pressure and ½ in. of ice.

Conclusions reached involved a redesign through the exceptional loading area to provide:

1. A reduction in working tension on insulator strings.
2. A flexibility in wire supporting mechanism to allow some longitudinal movement of wires at all supports.
3. Additional strength in tower members near the base.



LINE HARDWARE ON LAGUNA BELL LINE

LIST OF MATERIAL FOR ONE COMPLETELY ASSEMBLED GROUND WIRE CLAMP FOR STANDARD TOWER ON THE LAGUNA BELL LINE

Item No.	No. Pieces Required	Description
15	1	Ground-wire clamp cap
16	1	Ground-wire clamp base
17	4	Ground-wire clamp bevel washer
18	4	¾-in. square-head bolts, two hexagonal nuts and lock washer

LIST OF MATERIAL FOR ONE COMPLETELY ASSEMBLED SUSPENSION INSULATOR STRING FOR STANDARD TOWER

Item No.	No. Pieces Required	Description
1	1	Suspension shield ring with inset bolts
2	1	Supporting arm for shield ring
3	2	Suspension lugs
4	1	¾-in. x 4½-in. bolt, hexagonal nut and washer
5	1	Arcing horn
6	1	Suspension-clamp clevis
7	2	Suspension-clamp-half
8	1	Strap insulator shield ring*
9	2	Arcing horn brackets
10	2	¾-in. x 1¼-in. bolts with hexagonal nuts and lock washer
11	8	¾-in. x 3¼-in. car bolts, one hexagonal nut and lock washer
12	1	¾-in. x 3-in. bolt, square-head hexagonal nut
13	1	Insulator pin
14	13	Suspension insulators with pins
14A	1	14 ft. length of .05 x .3 aluminum armor wire
14B	2	¾-in. x 1¼-in. bolts, hexagonal nuts

* Omit item No. 8, when arcing-horn items, Nos. 5, 9 and 10, are to be used. For each standard tower use item No. 8 for center insulator string and items Nos. 5, 9 and 10 for outside insulator strings.

The suspension form of support for dead-ends has taken care of the first two requirements. With this change the dead-end loading is largely shifted from porcelain to copper, reducing insulator tensions without increasing the number of insulators on the line. The suspension unit installed in places of former strain construction was made up of two strings of insulators in parallel with strain yokes at each end, which reduced the tension duty in the porcelain by half. This yoked double-string unit was installed to hang approximately in vertical suspension.

In replacing strain forms with suspension forms on long steep slopes where it is desired to have wire stresses unequal on each side of towers, it would be necessary to install additional tie-down strings on the up-hill side, offsetting by several feet the point of clamping the suspension and tie-down strings to wire. This provides for necessary clearances and gives some longitudinal flexibility. Had there been any sharp line angles in this section, the flexible construction could have been provided by installing additional towers so as to make a round turn with short spans, the suspension strings swinging out nearly horizontal. This form of corner construction has been successfully used on suspension insulator lines

along county roads and railroads where the right-of-way turns on a wide radius. It involves the use of bracket supports for inside insulator strings to obtain clearances.

Damage from snow to tower-leg members will be prevented by the installation of additional pieces of heavier angle stock alongside existing members, with the corner of the angle facing upward to form a roof effect and provide a cutting edge to break the snow.

DISCUSSION

In the discussion H. Michener said that weights instead of tie-down strings on the Big Creek 220,000-volt lines of the Southern California Edison Company required too much cast iron and therefore the tie-down construction is favored where there is a vertical upward strain on the conductors. R. J. C. Wood expressed the opinion that engineers may go too far in trying to eliminate dead-end strings. In the Big Creek lines of his company only two cases of trouble (flashover) have been experienced on dead-end strings.

In his paper W. Dryer suggested a possible economy in tower cost by stringing the conductors at lower tensions, but W. A. Hillebrand, San Francisco, in discussing the paper, questioned the economy of lower stringing tension.

R. J. C. Wood said the Southern California Edison Company had experienced trouble with conductors on a two-circuit steel-tower line, where the wires are in a vertical plane, because with the thawing of snow and ice a lower conductor may fly up into the one above.

According to J. P. Jollyman, the Pacific Gas & Electric Company received a report last winter that sleet had slid to the lowest point in a span, causing abnormal loading and sag. Horizontal configuration is used by this company in territory where there are heavy sleet storms to obviate this trouble. In the regions where sleet conditions are not so bad the company offsets the center conductor 3 ft., with 10-ft. vertical spacing of the wires. In light-sleet country it considers 20-ft. vertical spacing of conductors sufficient to avoid trouble in spans of 500 ft. or 600 ft. The experience of the Utah Power & Light Company with sleet and frozen moisture on its 130,000-volt vertical-conductor tower line has led it to offset the center wire by inserting another string of insulators and drawing the conductor in toward the tower, making a disalignment of 3 ft. as a precaution against further trouble. Discussion showed that most power companies of the West have had similar experiences, in some cases resulting in the failure of towers or conductors. The only remedy suggested was the offsetting of the conductors or horizontal configuration. Tests described by H. Michener which were made on one of his company's tower lines where the spans were loaded up with weights showed that with the center wire loaded and the bottom wire unloaded the center wire would hang down below the lower wire for three-eighths of the length of the span.

LONG-SPAN CONSTRUCTION

The problems of insulation design of anchors and tower supports and the importance of vibration in the 110,000-volt, 4,427-ft. span of the Pacific Gas & Electric Company over Carquinez Strait, were presented in a paper by L. J. Corbett.

In discussing this paper L. M. Klauber, San Diego, said that long spans require great engineering care in design whereas shorter spans may employ less expensive construction. His company recently built a 4,400-ft. span using wooden poles at no greater expense than for an equivalent in the adjoining line.

J. P. Jollyman pointed out that vibration is a serious factor in spans of great length and experience has shown that vibration will soon crystallize the conductors if some means be not provided to reinforce them. In redesigning the span in question great care has been taken to taper off the reinforcing wires by lapping. A few years ago a stiff reinforcing was used and within a few days the conductors crystallized and broke. The important feature of this span is that the insulators are worked under compression instead of tension.

Operating Problems

At the Friday morning session R. J. C. Wood presented a paper on "Theory and Practice in High-Voltage Operation." Mr. Wood told of the method of cutting over the 150,000-volt Big Creek transmission lines of the Southern California Edison Company to 220,000 volts. The big problem in increasing the voltage was to supply the large amount of charging current necessary to charge the 240-mile transmission lines. The transformers connected to each line supplied 16,000 lagging kva. and reduced the amount the generators had to supply by that amount. The first step in cutting over was to clear the West Big Creek line of all generators except the largest one at the Big Creek No. 8 power house. This machine was connected to the line and both were brought up to about 35 cycles together, at which point a 30,000-kva. synchronous condenser at the Eagle Rock receiving substation on the Los Angeles end of the line was disconnected from the 50-cycle system and allowed to coast down to the frequency of the line, at which point it was thrown in and the generator, line and synchronous condenser were then brought up to the normal system frequency of 50 cycles. A week later, when the second line was cut over, it was thrown in at full voltage without these precautions, and it went in without any trouble.

In operating the 220,000-volt system the company makes it a practice to keep sufficient generator capacity on the line at all times to take care of self-excitation of the generators by the charging current of the line in case of total loss of load. Switching on the lines has presented no difficulty. Long sections (100 miles) are switched in and out without any trouble. A proper proportion of synchronous-condenser capacity was made between the two terminal substations at the Los Angeles end of the line to obtain proper voltage regulation. These stations have been operating in parallel, but it is planned to operate them independently to give more latitude in the operation of the synchronous condensers installed. It has been found that there is less trouble in switching at the center of the transmission line, and in case of trouble the switches at the center are opened last and patrolmen work from the center each way.

J. E. Woodbridge, San Francisco, asked what the procedure is in case of the total loss of a line and the re-establishing of service. Mr. Wood replied that this condition has not occurred, but that if one line was lost the company would simply switch it in again. In case of flashovers the procedure is to lower the voltage at all of the generating stations simultaneously until the trouble has cleared and then re-establish normal voltage. On the old 150,000-volt system, and so far on the 220,000-volt system, this has been done manually by manipulation of the field rheostats at the generating plants. A system of relays is now being installed, however, which will perform this operation automatically and in much shorter time than is required under manual operation. J. P. Jollyman asked if anything had been done to use overvoltage relays on synchronous equipment to protect it in case a piece of line was left on a machine which would overload it. Mr. Wood said that 90,000 kva. of synchronous condenser capacity is cut in solid on the receiver end of the lines at two places and there is no likelihood of such trouble. J. A. Lighthipe, Los Angeles, said that the starting of the 220,000-volt system was no great occasion and "we are going higher."

GROUP OPERATION OF SYSTEMS OF DIFFERENT FREQUENCIES

L. M. Klauber, in discussing the paper by E. R. Stauffacher and H. J. Briggs on "Group Operation of Systems Having Different Frequencies," * said that a small company such as the San Diego Consolidated Gas & Electric Company tied in with a system the size of the Southern California Edison Company experienced trouble because of the frequent tendency of the small system to take a large and fluctuating amount of power. This is due, he said, to the fact that the governors on the steam turbines on the San Diego system are more sensitive than the governors on the hydraulic units of the Edison system. His company has experimented with two means of overcoming this trouble. One is by placing a rod on the governor of the steam turbine and applying friction to this rod and the other is by opening all of the regulating valves on the turbine and operating

*This paper will be abstracted in a later issue.

it by hand control. P. M. Downing, San Francisco, said that load control, in such cases presents a difficult problem. He thought that a small system trying to operate in parallel with a larger hydro-electric system must naturally expect trouble due to the difference in sensitiveness between steam turbine and waterwheel governors.

In presenting his paper on "Test Results of the Performance of Suspension Insulators in Service" C. F. Benham said that the important thing in insulator failure is the temperature cycles the insulators go through. Speaking of failure in dead-end strings, J. A. Koontz, Jr., said that if loading on dead-end insulators is kept down within reasonable limits, there is no more depreciation and deterioration than in suspension units. The practice of his company is to set a limit of 3,000 lb. per string of 10-in. insulator units. W. A. Hillebrand emphasized the importance of holding down working loads to moderate limits on suspension.

High-Voltage Equipment

Lightning-Arrester Practice and Experience—Need for Record of Lightning-Arrester Performance Emphasized—Operation of High-Voltage Circuit Breakers

OPINIONS on and experiences with lightning-arrester performance on the Southern California Edison system were presented in a paper by Harold Michener. The general policy of the company until within a year or two had been to install electrolytic arresters on lines ranging from 11 kv. to 150 kv. Experience with this type of arrester showed that they should not be installed inside of buildings, because of fire hazards, nor on a roof, because of these hazards and the deleterious effect of oil on composition roofing.

The actual value of lightning arresters is difficult to determine, in the opinion of Mr. Michener, because no accurate records are available and lightning trouble is rare in the territory served. It is generally conceded by the company that arresters afford a worth-while protection on 15-kv. circuits and lower. On the 60-kv. system the case is not so clear for the arrester. The fact that they are installed shows, however, the predominant opinion.

Arresters Discontinued

The 150-kv. system was completely equipped with electrolytic arresters until about a year ago, with the exception of a considerable period some years ago when the arresters at Big Creek No. 2 were out of commission. Since about a year ago the arresters have been taken off the lines, as the 220-kv. construction work made that necessary, and the fire at Eagle Rock eliminated those at that station. The fire brought forth the decision to abandon permanently the use of lightning arresters on the 150-kv. stations at Big Creek No. 1 and No. 2 and at Eagle Rock, where the arrester tanks were inside the buildings. It had previously been the intention to leave these arresters in service, although the lines had been changed to 220 kv. It has not definitely been decided whether or not the outdoor arresters at Vestal will be reinstalled.

On the 150-kv. lines there have been only two or three cases of trouble due to lightning. One of these was at Eagle Rock after the 150-kv. arresters had been removed. A 150-kv. insulator inside the building flashed over during a storm which was causing trouble on the 60-kv. and 15-kv. lines out of the same station. Another case of trouble attributed to lightning occurred on the 150-kv. bus connection inside the building at Big Creek No. 1, when the arresters were connected to the lines and apparently in perfect working conditions. At Big Creek No. 2 it was reported that the arresters discharged heavily at a time when lightning struck so near that the operators thought the building had been struck.

The arresters on the 150-kv. lines always discharged when 150-kv. line switching was being done. The statement is often made that arresters are not needed on 150-kv. and 220-kv. lines as a protection against lightning, but what will these voltage surges which cause the lightning arresters to discharge during switching do if the arresters are not there? The answer is, even though these voltages are high enough to jump the arrester gaps, they are not high enough to damage the station equipment. The fact that Big Creek No. 2 operated for many months without arresters indicates this. Recent studies made with a surge recorder on the 150-kv. lines indicate that switching of a 100-mile section of line does not produce surges of more than 200 per cent normal voltage. These studies were made at Eagle Rock while the 150-kv. arresters were in service, however.

At Vestal, near the middle of the 150-kv. line, there were two cases of 150-kv. transformer insulation breakdown. The transformers were old and the insulation was admittedly of a quality inferior to that used in modern transformers. Yet the extreme thickness of insulation punctured made it difficult to believe that inferior insulation could be the cause of the failure. Perhaps high voltage did it, but the 150-kv. lightning arresters were in service, having very advantageous connections to the 150-kv. lines. On the 220-kv. lines there are no lightning arresters and probably never will be.

In regard to the types of arresters used by the company, the electrolytic arresters, which until the last two or three years were considered the only arresters at all adequate for station service, have several faults, one of which is that they require expert maintenance, which often they do not get. Another fault is the fire hazard.

The oxide-film arrester has become popular and the company is installing many of them on voltages of 60 kv. and lower. Thus far they have given no trouble and it is assumed that they will give at least as good protection as the electrolytic arresters. There is apparently no fire danger from them and this is greatly to their advantage. The maintenance promises to be very low. There has been one case of a discharge throwing some of the active material out of a stack of the disks. Examination showed that there had been many discharges through this stack. This discharge occurred at the time of a heavy short circuit on the system and the arrester was in the heart of the system.

There is only one installation of the autovalve arresters of the distribution type on the system. This is on a 15-kv. line on Mount Wilson at an elevation of 5,000 ft., and though it is not definitely known to have functioned, at least one lightning storm has occurred on that part of the system since its installation.

The graded-resistance type of lightning arresters have been installed on 11-kv. lines at several stations during the last two years. These have given no trouble to date and have functioned satisfactorily in several instances.

There is one installation of the water-column surge arrester on the system. It functions properly when an arc is formed intentionally across the horn gap, but that is all that is known of it as yet.

Referring to the subject of lightning arresters, E. R. Stauffacher emphasized the need for a reliable and cheap lightning-discharge recorder to be installed on a set of lightning arresters to obtain a record of their performance over a period of time. It is his opinion that the real value of lightning arresters will not be determined until such a device is brought out.

High-Voltage Switches

H. Michener, in continuing his paper on the experience of the Southern California Edison Company with high-voltage switches, bushings and lightning arresters on its 150-kv. and 220-kv. systems, said that no trouble has been experienced with the 220-kv. circuit breakers on the Big Creek lines since they have been made automatic. One flashover has occurred since full automatic operation of the breakers, and the section of the line where the flashover occurred cleared itself from the system without any trouble. The method of going to automatic operation was first to set the relays heavy and then decrease the setting by steps until the proper point was reached. His company has found it necessary to install oil

circuit breakers to break the arc of paralleling switches. On one occasion when air-break switches were in use a high wind carried the opening arc over and caused a flashover. The author stated that since his paper was written there has been one case of trouble on a 60-kv. oxide-film lightning arrester in which the arrester blew up, throwing out several of the disks between line wire and ground.

In connection with his paper on "High-Voltage Circuit Breakers," A. W. Copley exhibited some slides showing the construction of high-voltage circuit breakers. In discussing the papers on circuit breakers J. S. Thompson said that his company had developed a circuit breaker with six breaks per pole without increasing the insulation to ground. One of these circuit breakers was recently tested and after being subjected to thirteen successive operations on 60,000 volts, including two dead short circuits on the system, which was of large capacity, the switch showed no signs of trouble except minor pitting. Oscillograms showed that the circuit was opened in a total of 30 cycles with an initial current of 2,000 amp., which dropped to 1,300 amp. before the circuit was opened. Prof. R. W. Sorensen, Pasadena, called attention to the lack of information on the methods of technical analysis employed to study the phenomena involved in opening electric circuits where large amounts of energy are involved. He applied some of the formulas of M. Charpentier to determine the theoretical interrupting capacity of circuit breakers, with the result that interrupting values were obtained from one and one-half to several times the known interrupting capacity of some of the breakers.

In commenting on lowering the voltage on the 220,000-volt transmission lines during the operation of sectionalizing switches, a practice of the Southern California Edison Company, R. M. Spurk, Schenectady, stated that it is preferable to use automatic circuit breakers for sectionizing purposes because of better continuity of service. Although breakers are highly expensive, their expense is justified. The reason they are expensive is because they have to be designed for 220,000 volts, and it is the voltage that makes the high cost rather than the interrupting requirements. One of the types of circuit breakers now in operation on the 220,000-volt system on the Pacific Coast utilizes the explosion-chamber principle. He enumerated the advantages of the explosion-chamber-type breaker and asserted that exhaustive tests had been made not only in the field but in the factory which permit the interrupting ratings to be figured with considerable accuracy.

HIGH-VOLTAGE TRANSFORMERS

Clinton Blume, Schenectady, in commenting on the paper by Messrs. Mini, Moore and Wilkins on "Performance of Auto-Transformers with Tertiaries Under Short-Circuit Conditions," said that the paper involved many interesting problems because the transformer connections to which the authors refer are a mongrel development which has inherited its present traits from three distinct sources. In this one transformer connection are combined the various aspects of (a) an auto-transformer, (b) the Y-connection and (c) the three-winding transformer. He brought out a few of the salient characteristics of the three-winding transformer, saying that it is being employed for two distinct reasons, one being based on economy both in first cost and operation and the other being the desire to obtain specific improvements in operating characteristics. The one purpose may be called the economical use and the other the non-economical use of the three-winding transformer. There are two new problems introduced by this transformer—first, the determination of size of the tertiary winding may not be obtained in the ordinary manner, but by one or more of the unique functons which it is called upon to perform; second, the three windings are so related to each other that impedance and regulation cannot be so simply expressed as in ordinary transformers, although by means of a simple equivalent impedance values can be determined for each winding and these values used in the ordinary formula to obtain regulation or current division for any given condition. Besides these features, three-winding transformers are not in any way different from the ordinary transformer.

The paper by A. W. Copley on "Transformers for High-Voltage Systems" was discussed by Prof. R. W. Sorensen. He said: "I doubt the advisability of saying that engineers are universally of the opinion that 220,000-volt systems should be provided with solidly grounded neutrals only. As such a system grows it may be necessary to use Petersen coils or a resistance of some kind in the neutral of the 220,000-volt system and also for systems of other voltages, even though we have by long practice accustomed ourselves to the use of solidly grounded neutrals on the Pacific Coast."

Mr. Copley, in closing the discussion, said it had not been seriously proposed that circuits of 220,000 volts be operated in any other way than with grounded neutrals and he did not think that the Petersen coil is applicable. He said he does not recommend the use of tertiary windings for general use except under special conditions where the load imposed by the synchronous condensers is such that there is good voltage regulation of the tertiary winding.

Carrier-Current Telephone Systems

Experience with Two Installations, One of 200 Miles Length, Cited—Load-Dispatching Operations Carried on with Entire Satisfaction

SOME very interesting experiences with carrier-current systems were described. L. F. Fuller discussed recent developments of the system and expressed the opinion that such systems are practicable and reliable.

Calling is accomplished on existing carrier-current channels either by one or more gong bells operated by a local relay or by means of a loud speaker which permits direct voice or "howler" calling.

Each method has its inherent advantages and disadvantages. The loud speaker cuts the time for short dispatching orders almost in half when operators are constantly within hearing distance. In such cases calling and answering calls are dispensed with. The dispatcher gives an order and the station to which it was directed repeats it. The Great Western Power Company has used this method for more than a year and the Pacific Gas & Electric Company has also found it satisfactory.

If there are several carrier sets on a system which intercommunicate frequently, it is often annoying and generally undesirable to have a loud speaker talking when its station is not concerned with the conversation. In one installation there was an objection to the loud speaker, not because of undesired conversations, which did not exist in this case, but because of the line and electric storm noises which were reproduced. Relay and gong-bell ringing is necessary in such cases.

Selective ringing is a further refinement which may be employed when code ringing of a gong bell would cause annoying and unnecessary disturbance at several stations of which only one is desired.

Time-limit attachments are often furnished with the calling relay system to prevent electric storms and other high-frequency disturbances from ringing the gong bell. Code ringing is possible with such attachments, since the time-limit feature is automatically inoperative after the first signal, which must be a long dash. It may be followed by any desired dot-and-dash combination.

An excellent calling system is a relay with time-limit attachments arranged to connect a loud speaker in circuit at the end of the long dash above mentioned. A gong bell may be added if desired. In this way the loud speaker does not reproduce undesired noises, but comes into service automatically for any speech or code calling.

A selector system may be added to such a combination. In this case the loud speaker is connected in circuit only when its station is called, but after being connected the message may follow immediately, if desired, with the resultant saving in time.

Duplex operation was considered unsatisfactory by Mr. Fuller, but the use of continuous or intermittent wave telegraphy provides an important adjunct.

Experiences with a carrier-current installation on the lines of the Pacific Gas & Electric Company were given by E. A. Crellin. The carrier current since April, 1923, has answered all dispatching requirements. The carrier system is coupled to the transmission line by a single-wire antenna about 1,800 ft. long. The system ground is used for the carrier ground and a frequency of 50,000 cycles is used.

The transmission equipment is similar to that installed in several of the high-powered broadcasting stations in some respects, and employs two 250-watt oscillator tubes, two 250-watt modulator tubes and a 50-watt speech-amplifier tube. It is appreciated that this is a relatively high-powered transmitter and that for all normal conditions of operation such an amount of power is not necessary. However, communication is more urgently needed during periods of abnormal condition than at any other time, and it is then that this excess power is called upon to get the message through.

Calling is accomplished by mounting a standard telephone microphone in the horn of the loud speaker which, when the calling circuit is completed, will oscillate and "howl" much as the ordinary telephone will "howl" when the receiver is placed against the transmitter. This gives a very loud note whose pitch will depend upon the natural period of oscillation of the diaphragms and which is clearly audible in all parts of the station. Ordinarily, it is not necessary to use the calling system, as the receivers are always in service and the operator near the set, so that the loud speaker simply talks at him and he starts up his set and talks back.

The system is arranged for simplex operation, and all that is necessary is to operate a small telephone switch which energizes a contactor to connect either the transmitting or receiving set to the antenna, thus permitting talking or listening. Some tests made with a view to establishing the possibility of operating as a duplex system are described further on in the paper.

Normal rating of the 250-watt tubes used is based upon a filament lighting supply of 11 volts and a plate pressure of 2,000 volts. With the transmission line in operation and all conditions normal, it is possible to obtain an antenna radiation of 6.2 amp. with the tubes operated at rated voltage. This gives a received signal at the other end of the 202-mile transmission line considerably louder than necessary. The receiver is a standard regenerative set using two stages of audio-frequency amplification to operate a loud speaker, and speech can be heard all over the power house when maximum amplification is employed. For regular service, therefore, the filament lighting supply on the transmitter is reduced to about 10.4 volts and the plate pressure to 1,600 volts, which gives an antenna radiation of approximately 5.0 amp. The tubes are extremely sensitive to variation in filament voltage, and it has been found by experience that 10.4 volts is about as low as it is desirable to operate.

Communication cannot be carried on with three-phase grounds at either or both ends of the transmission line. All three wires were recently grounded at Hat Creek, about 3 miles distant from Pit toward Vaca, and communication could not be carried on. At least one wire insulated from the ground between the two points is necessary for successful communication by carrier-current telephone.

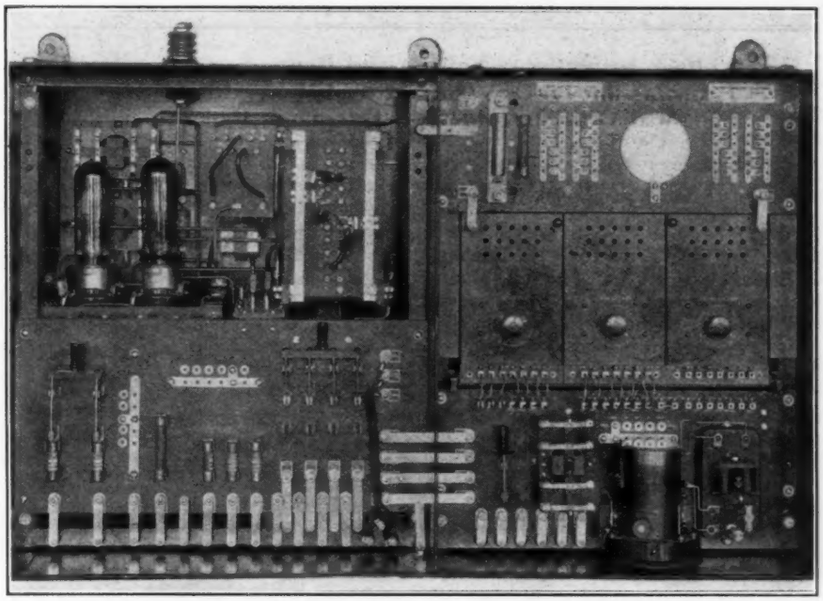
When the transmission line is dead and isolated, by opening the disconnecting switches at each end of the line considerably more power output from the transmitter is required than when the line is connected to the transformers and energized at 60 cycles. This difference is probably due to the change in transmission-line constants by the removal of the reactance of the transformers, which in turn cuts down on the current radiated from the antenna. When the transmission line is thus isolated, the station operators immediately increase the power output of the carrier-current telephone transmitter to its maximum by raising plate and filament voltages to 2,000 volts and 11 volts respectively. Communication is then carried on as usual and no difficulty is experienced in directing operations.

The Pacific Gas & Electric Company is entirely satisfied with the results from the carrier-current telephone thus far obtained. Many conditions of operation have been met and the carrier-current telephone has at all times been ready to perform the duties required of it. The principal difficulty to be overcome is that of understanding the loud speaker, which is simply a matter of becoming accustomed to the voice as reproduced in a loud-speaker horn rather than in a telephone receiver. The operators in general seem to prefer the loud speaker to the head telephones and rely upon it at all times to receive their messages.

GREAT WESTERN CARRIER SYSTEM

The Great Western Power Company has used a carrier system on its high-tension lines, and J. A. Koontz, Jr., described the installation. Two 250-watt tubes are used in the oscillating circuit and one 250-watt modulating tube. The system has been in operation for more than a year with very satisfactory results.

Because of the complex circuit arrangement at times an echoing effect exists during reception. This is possibly due to the carrier current flowing along lines that have different characteristics, producing different attenuations, or due to reflection. There is, however, one very peculiar thing about this effect. Often by shifting a substation from one of the twin circuits to the other the effect will be eliminated, and thus far no reasonable explanation has been given why this change should eliminate the trouble.



TRANSMITTER-RECEIVER FOR 50-WATT CARRIER-CURRENT TELEPHONE

The general equipment consists of a 2,000-volt, three-wire direct-current generator for producing suitable plate voltage for the tubes, 1,000 volts being placed across the 50-watt amplifier tube and 2,000 volts across the 250-watt tubes. Filaments are lighted from alternating current, with rotary converters provided for supplying this current from the station storage battery should there be a failure in the alternating-current supply at the dispatcher's office.

The "simplex" system of communication is used, it being necessary to operate a double-pole, double-throw switch to change from talking to receiving. The antenna are strung upon the towers at two of the stations, while

the Caribou antenna is stretched across the canyon about 40 ft. from the high-voltage wires. Here a single ⅜-in. steel-core aluminum cable 930 ft. in length is used, tapped at the center, giving a T-type aërial. The wire used is the same as that used on the tower circuits.

The carrier-current system has several features which undoubtedly will be of interest to the operating power men. First, it is a good detector of poor switch contacts, as the minute a switch is closed a click can be heard on the loud speakers indicating that the switched is closed, and should the contacts continue to arc, a hissing or howling noise will immediately be set up in the loud speakers. In this way faulty switch contacts have been located and taken out of service before any trouble occurred. Arcing grounds on the secondary systems can be instantly detected, though often hard to locate.

The system is operating on a wave length of 5,500 m. This particular wave length was selected after careful test as giving about the best transmission. It was of suitable length to avoid most outside telegraph interference, placing the station just between two of the high-powered government telegraph stations. The transmission lines make a good antenna for the longer wave lengths—3,000 m. to 20,000 m.—but a very poor one for wave lengths covered by the amateur or broadcasting range.

Miscellaneous Subjects

High-Voltage Insulation—Voltage and Power-Factor Control of Transmission Lines—The National Power Problem—Waterwheel Problems—Telephone Papers

A FINE paper on "High-Voltage Insulation," by J. L. R. Hayden and C. P. Steinmetz, was abstracted by Mr. Hayden. Prof. R. W. Sorensen, Pasadena, said: "We are deeply indebted to Steinmetz, Hayden, Peek, Ryan, Whitehead and others for the careful work they have done in providing methods of analysis of insulation values. This paper presents the phenomena of breakdown in a way so greatly in contrast with our habits of thinking developed from a study of the standard works in physics as to make us think at first glance that contrary opinions are expressed by the authors. Unfortunately, we have not had the paper long enough to check the results and bring to our own minds an understanding of the meaning of a number of statements. For example, we are surprised to discover that breakdown occurs more readily from point to sphere when the point is positive, whereas we have for many years been informed by Townsend and other investigators that breakdown occurs more readily at a given voltage when the point is negative."

In discussing the paper by J. A. Koontz, Jr., on "Methods of Voltage Control of Long Transmission Lines by the Use of Synchronous Condensers," A. W. Copley said: "There is a very definite power limit on a transmission line on which the generator and receiver voltage has been fixed, beyond which the addition of synchronous equipment does no good. It is possible, however, to increase the power limit of a long transmission line by breaking the line into two parts and installing synchronous equipment at the center and at the end. For instance, on a line operating at 220,000 volts it would be possible to increase the capacity of the line from 125,000 kva. to 200,000 kva. by this means."

R. J. C. Wood, Los Angeles, in referring to Mr. Copley's statement, said that a study of the Big Creek transmission lines of the Southern California Edison Company indicated that there was no advantage in placing synchronous equipment at the center of the line. There is no advantage in dividing short lines and considering a part of them as a new line.

Frank G. Baum, in discussing the paper on "The Economic Considerations of Power-Factor Control of Long High-Voltage Transmission Lines," by A. V. Joslin, said that a 220,000-volt line of any length at a load of approximately 120,000 kw. is self-regulating and the voltage is equal at all points along the line. If it were possible to hold the load at this value, then synchronous equipment would not be necessary. For less loads lagging kva. is supplied at points along the line and for greater loads leading kva. is supplied. The point is reached at which the line becomes unstable at approximately 160,000 kva., or on an overload at 200,000 kva. on a 500-mile, 220,000-volt line.

"Some Factors in the Power Problem of the United States" was the subject of an address by F. G. Baum. In illustrating the importance of a national power scheme Mr. Baum said that the combined output of all the plants in the United States varies only about 10 per cent from month to month, whereas the outputs of individual plants vary as much as 50 per cent. The importance of interconnection is shown by the fact that California has a capacity factor of 46 per cent, whereas Missouri for instance has a capacity factor of only 17 per cent. This is because of extensive interconnection in California as against isolated plants in the case of Missouri. "We cannot realize the greatest economies in power generation and transmission until we have a comprehensive interconnected system on a national scale. The amount of reserve capacity is reduced to the smallest possible extent by interconnection."

Instead of abstracting his paper on "Waterwheel Construction and Governing," E. M. Breed presented an illustrated talk showing some recent developments in hydraulic turbines. He pointed out the advantages of the propeller-type runner and spoke of the recent development in governor design by which the operator may change from automatic to manual control by merely throwing a lever.

Roy Wilkins, in abstracting his paper on "A Study of Irregularity in Francis Turbines," * said that vibration in Francis-type turbines is due to the lack of clearance between the guide vanes and the runner blades. In overcoming the vibration on its Pit River units the Pacific Gas & Electric Company cut back 2½ in. on each side of a runner of 105-in. diameter without impairing the efficiency or load as far as could be determined.

Robert Treat suggested the application of the device used by Mr. Wilkins to determine the point of vibration in hydraulic turbines and to determine the pressure in oil circuit breakers and porcelain insulator supports. R. L. Hearn expressed the opinion that some of the vibration experienced with the units described in John Harisberger's paper on "Experience with Bearings and Vibration Conditions of Large Hydro-Electric Units" was due to the draft-tube design. He felt that the Moody type of draft tube would help in overcoming the trouble.

In the discussion E. M. Breed said that the manufacturer has realized that vibration in the larger-sized units would be a serious problem. He felt that operating companies by such tests as described by Mr. Wilkins will greatly assist the manufacturer in overcoming this trouble. "The manufacturer has approached the problem from the angle of the vibration set up by varying the number of guide vanes and the number of buckets. If the difference in number is even, the vibration is regular and hence more destructive, whereas if the difference is odd, the vibration is irregular and moves alternately from points diametrically opposite backward around the turbine." John Sturgis said that he looks to see an entirely new roller-type gate as a result of the development of the propeller-type runner.

H. W. Hitchcock, in presenting his paper on "Applications of Long-Distance Telephony on the Pacific Coast," showed some interesting pictures of the laying of the telephone cable from Avalon, on Catalina Island, to San Pedro. H. F. Osborne, in presenting his paper on "Telephone Transmission Over Long Distances," showed some slides of oscillograms of currents set up by voice energy in a transmitter. He said that the wave filter has been an important factor in the development of carrier-current telephony by filtering out wave lengths of different frequencies.

*This paper will be abstracted in a later issue.

An Engineer's Analysis of

Why Some Appliances Are Not in Use

Need for More Rugged Construction, Better Design and Education of User—Too Many Household Devices Fail Within a Few Months—Central Station Repairs Do Not Solve Problem

By E. S. LINCOLN
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HOUSEHOLD appliances have undergone many improvements in the past few years, but there is still room for more durable products. Some manufacturers have made more progress than others and are producing reliable and efficient articles, but a number of them are not looking at the appliance business from the standpoint of the consumer and central-station company. Yet unless appliances are used they are of no value to the consumer and are bringing no returns whatever to the central station. It is far better for a central station to sell five hundred appliances and have them all used than to sell a thousand and have only three hundred used.

There are many devices on the market that have excellent heating elements and are very efficient electrically, but are deficient in little mechanical details that spoil the whole device. Household appliances are the weakest link in the electrical chain. They have not received from the manufacturer the same attention as power equipments. On the other hand, appliances are used by people unfamiliar with electricity. For this very reason they should be as nearly foolproof as possible and very durable. Ever since appliances first appeared I have been a liberal user in my home. I use all appliances from the electric range down to the soda mixer and have spent many evenings and Sundays making repairs, although I always purchase the best articles obtainable. About 80 per cent of the repairs have been necessitated by poor manufacture and design, the two being probably equally divided. The remaining 20 per cent are divided between natural wear and tear of the appliance and irregularity of voltage, the latter trouble having since been corrected.

As a result of experience in using and testing these appliances, I feel that a few suggestions as a customer may be of interest and assistance to the electric utility and some of the appliance manufacturers. I wish it understood that these suggestions are made in a friendly way with the idea of assisting those who are interested in making improvements and bettering this branch of the industry.

APPLIANCES NOT SEASONED

A number of manufacturers have been and are still putting out a product that has not been carefully "seasoned" and are continually making changes in their line that reduce cost as well as reliability. These manufacturers are letting the public do their experimental work, which is a very risky thing and often leads to failure. The manufacturers are getting their experience at the expense of the central station and the dealer.

The failure of an appliance hurts in many ways, much more so than the manufacturer realizes. I have heard a manufacturer say that all that was necessary for a customer to do was to send back the appliance if it went wrong and he would make it good. This, of course, is true, and any reliable firm would do the same thing, but the damage has already been done, and the difficulty in many cases could have been eliminated by more care in the original design and the construction by the manufacturer.

Some typical cases will illustrate the results of failure in an appliance from the user back to the manufacturer. Here are a few cases taken from actual practice which represent only a few out of several hundred which have come to my attention within the last few years:

1. A WASHER EXPERIENCE—For a typical illustration consider a progressive jobber who represents a manufacturer in his territory. This jobber sold a line of washers to a central station which was disposing of them at retail to its customers on a partial-payment plan. The central station entered into an extensive sales campaign of this machine as it had been very highly recommended by the jobber and had been well advertised. One machine was sent direct to the customer's premises and uncrated. It was found that the crate covered only three sides of the machine and that the fourth side was left entirely exposed. During transit it had come in contact with some other material and was badly dented. If the crate had been properly made, such a thing would not have happened.

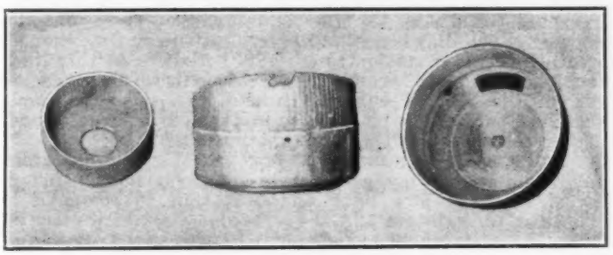


FIG. 1—STEPS IN FAILURE OF SWITCH ON ELECTRIC RANGE

After the machine had been uncrated it was found that the motor was supported on a wooden base, and during transit this base cracked as it was mechanically weak. This threw the motor out of line and a new base had to be made. A small operating handle had also jarred out of position while in transit and was lost. After waiting a week for a new handle to replace the one that was lost, the machine was finally put to work. It operated splendidly for about a month and then began to show some of the defects that are common to many washing machines.

The customer called the utility salesman on the telephone and explained her difficulty. This salesman had to give up half a day of sales work in order to make an investigation of the washer. He found that the drain at the bottom of the washer had become unsoldered on one side but was being held in place by two rivets. These rivets were mechanically strong, but the soldering was very poorly done, and as the whole bottom was flimsy, it gave way with the frequent use of the drain. The customer had to meet with this difficulty by continually keeping a pail under the washer.

But the real cause of the complaint was the fact that the switch which was used on the machine was very weak

in its construction and the continual small arc in breaking the contact had charred the fiber insulation until it finally broke and rendered the machine inoperative. The customer also told the salesman that she could not leave the machine for any length of time as the wooden cover on the revolving drum was very apt to fall off and stop the washer altogether. This would "stall" the machine and the slipping of the belt would fill the room with smoke. It was found that the screws were loose and the cover had not been properly fitted to the drum. In going over the machine the salesman also noticed that the manufacturer had neglected to put any grease in the grease cups and that in a short time there would have been further trouble from this cause.

In the above case the switch was renewed free of charge as one of the utility company's employees placed it on the machine so that it did not cost the customer a cent. However, the customer was obliged to pay $5.50 for a plumber to come out to the house and resolder the drain to the bottom of the washer. To return the washer to the manufacturer would have cost $30, and the customer would have been without its use for at least six weeks.

With due respect to this housewife, the instance was given considerable publicity, especially to prospective

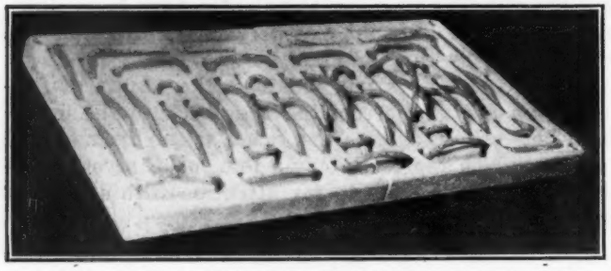


FIG. 2—POORLY DESIGNED INVERTED HEATING ELEMENT

buyers. Unfortunately many of these difficulties are exaggerated, especially as the story passes from one to another. Such difficulties and several others not mentioned forced the central station to curb its activities in this line. Machines that went wrong caused a loss in several ways—first, in the sale of current; second, the sales cost was excessive, eating all possible profit; third, it was found hard to collect the full price of the machine.

2. A RANGE EXPERIENCE—A few years ago the electric range was one of my greatest problems, but after using several makes I now have an outfit that in comparison costs little to maintain and is very economical in its operation. My maintenance cost for material alone averages $1 per month, not including labor. This is a low figure, and in many cases it runs as high as $4 a month. It was necessary to educate my family about every detail of this range in order to get results, and much more instruction being necessary than with any other means of cooking.

In some towns where ranges were recently tried they proved so poor that it was impossible for the utility to do any business with this appliance in spite of an exceptionally low rate. Some of the smaller things that give trouble are switches, contacts, oven door handles, temperature indicators and poor location of switches, all of which are a bother to the consumer.

I am always having difficulty with the insulating lining in the snap switches when the switch is placed directly in front of the heating units of the range. It is impossible to keep it dry when placed so near the cooking utensils. This lining becomes moist and will then conduct electricity in sufficient quantity to burn up eventually the whole lining. (See Fig. 1.) This is very noticeable on the 220-volt ranges. On the 110-volt ranges the lining will dry out so thoroughly that it will finally crack and break away, thus causing a short circuit in the switch. Referring again to Fig. 1, examine the fiber switch lining. This lining has absorbed moisture and is just beginning to steam and burn. At the top on the inside can be seen a bulge in the lining. This is caused by expansion due to steam between the layers in the fiber. The same picture shows where the lining has burned through and a short circuit results, burning a hole in the metal cover. Another hole in the metal cover which resulted from the same cause is shown. These switches, when new and tested in the laboratory, withstood a dielectric test of 2,200 volts between the cover and the switch terminals inside. An air space between the switch contacts and the fiber linings of the switch cover would reduce this difficulty to a minimum. If the switch cover is not grounded, it will give the operator many unpleasant shocks.

Fig. 2 illustrates difficulty incurred with the *inverted* heating unit as used in an oven. By examining this picture it will be noticed that the heating wires hang down from the unit about 1½ in. from the surface, making it possible for them to come in contact with the contents of the oven. The active heating wire has not been properly supported.

Many ranges have spaces between the units and the range proper that will accumulate dirt, and it is impossible to remove this dirt without taking the units out altogether. One of the most essential things on an electric range is to see that no food is spilled on the heating units, especially those of the open type. I have been told by a salesman that this means nothing to exposed coil units, which would soon burn up the food, when it could be brushed away. This is true, but in many cases it has burned out the unit at the same time. With the inclosed type of units this trouble is not so probable.

I have found one type of range useless on a three-wire system with the neutral grounded, but on the non-grounded, two-wire system the range would give fairly reliable service. This range employed exposed coils in the heating element, but they were covered by a slotted iron grating. As this grating was grounded and was only ¼ in. above the active element, a short circuit would result whenever any food was spilled on the unit and allowed to carbonize. After having replaced five units within six months' time I gave up the range altogether. I received no assistance from the manufacturer, who stated that the range was all right in every respect and offered as a proof that the device had been "approved" by some household magazine and this alone was sufficient indorsement to make the range satisfactory to any one.

Another great difficulty with ranges, and in fact with all heating devices requiring a large amount of energy, is in the electrical contacts. This is especially true if the contacts become heated. Unless the contacts are very tightly made and perfectly clean, they are almost sure to give trouble. The best results are obtained when the contacts are made under considerable pressure. There are very few devices on the market today that have not shown the difficulty very prominently.

3. RESULTS OF IMPROPER DESIGN—Air heaters, especially in the larger sizes of 1 kw. and over, have given considerable trouble because of the poor contacts between the heating element and the leading-in wires from the switch. In many cases they have burned off completely after the heater has been in operation for a short time. (See Fig. 3.) The controlling switch is often of insufficient size or has been placed too near the heating element, which results in the fiber lining becoming badly charred and finally breaking, allowing the switch to short-circuit, as already shown in Fig. 1. One of the greatest difficulties with the smaller heaters has been due to "burn-outs." Another difficulty with air heaters has been due to their being put together by numerous small bolts without lock washers or double nuts, with the result that vibration during transportation often makes them fall apart.

4. Toasters and flatirons are the leading appliances and are more universally used than any others. Undoubtedly, the percentage of failures in toasters is small compared with the number in use, the greatest difficulty being with burn-outs. On the other hand, the toaster is comparatively simple and has everything in its favor for reliability. Some of the more modern toasters put out recently are excellent electrically but poor mechanically and are not so durable as they should be.

The electric flatiron is a different matter and is subjected to hard usage. While repairs on irons, on the whole, are large, this is to be expected because of the enormous number in use. The first thing to wear out on a good flatiron is the cord. Mechanical devices for testing

MISCELLANEOUS DATA ON TWELVE MAKES OF STANDARD 6-LB. IRONS

Flatiron	Number of Screws to Remove Heating Unit	Temperature of Top (Degrees) with Bottom at 400 Deg. F.	Watts at 110 Volts
A	1	120	594
B	1	125	478
C	7	160	522
D	7	135	458
E	7	128	478
F	3	222	550
G	5	159	561
H	4	230	605
I	6	180	440
J	8	175	473
K	5	197	616
L	7	120	577

cords do not represent actual conditions as the cord receives much more and different bending. It is usually wrapped tightly around the handle when not in use.

Unless the heating element of any household heating appliance is the best it is not worth selling at all. Burnouts are, however, bound to occur in time, and under these circumstances the manufacturer should make the questions of renewals as simple as possible. The units in very few irons can be replaced readily, and a good field is waiting for the manufacturer who will put out a device where the unit can be easily renewed by the consumer.

COMPLICATED ASSEMBLY OF SOME APPLIANCES

Many irons are held together by a number of screws which become loose after the iron has been in use for a short time. During an investigation some time ago I found that manufacturers use anywhere from one to eight screws to hold the device together. The accompanying table shows the number of screws used in different irons to hold them together. With some irons it is necessary in order to replace a burned-out unit to take out at least seven screws.

I also found that many manufacturers do not consider the temperature of the handle of the iron. In many cases the handles get so hot that their use is uncomfortable, while others will operate at a temperature on the top under the handle of not over 120 deg. F. I have found irons whose tops reached a temperature of 230 deg. F., and this represents waste heat as well as discomfort in the use of the iron. Poor contacts which heat and eventually burn away are very noticeable in many makes of irons. The small arc is much more destructive than the continual making and breaking of the circuit If the contacts between the iron and cord are not absolutely tight, they will arc and eventually burn away.

5. The vacuum cleaner is another appliance which needs improvement, although a much better product is made today than was put on the market a few years ago. Recent improvements in motors and fans have helped a great deal, but many petty troubles with switches, handles, belts, etc., need to be looked after. A frequent trouble with belt-driven brush machines has been in the belt itself. The user never knows that the belt has broken and is missing unless he happens to notice that the belt is on the floor or to examine the machine before it is used. The cleaner does not clean satisfactorily without the brush, but the customer does not think it necessary to have repairs made, so the machine is eventually put away and not used and is considered a failure. The consumer should also be educated to the fact that the cleaner itself must be clean.

A great number of cases similar to the above have come to my attention, and interviews with others from all parts of the country convince me that the manufacturers should be more careful in analyzing trouble. Failures on their part hurt every branch of the electrical industry and lessen their own profits. Many consumers have given up the use of appliances on account of failures even after having repairs made. Repairs in many cases are simple when the customer can return the apparatus direct to the manufacturer. or if the utility or dealer maintains an appliance repair shop.

A repair shop is a necessity to those who wish to keep these appliances in use and obtain future business. It is the service that counts. If this department can be made to pay, so much the better, otherwise the appliance business is not attractive, especially to the dealer.

It usually costs the dealer or central station more to make repairs than it costs the manufacturer, and if the cost is very high in proportion to the original price of the device, this tends to discourage their use. Many purchasers will not bother with repairs. They go back to their old ways and stay clear of anything electrical. I have talked with many central-station men who say that they could not run an appliance department without maintaining a service department to look out for the difficulties.

It is not my intention to go into details of appliance troubles, but I want to bring out the fact that the continual use of these devices depends greatly upon the manufacturer. This is a point in which the central station, jobber and dealer are vitally interested. The majority of manufacturers will say that they have no trouble with their devices and can prove the fact by showing that very few ever come back to them. That very few go back is undoubtedly true, but it is not true that their goods are giving 100 per cent service. The fact is that they hear of only a very few of the troubles. The difficulties are taken care of by the customer or, more likely, by the central station or the dealers and do not reach the manufacturer.

The value of laboratory tests may easily be overestimated unless the man in charge has used the appliance in his own home. As a rule laboratory tests do not represent actual working conditions, and the device usually receives better treatment than in the home. The laboratory man understands how to look out for

FIG. 3—RESULT OF POOR CONTACTS ON HEATING ELEMENTS OF AIR HEATER

weak points far better than the average user and is apt to favor the device.

The real test of household appliances, more than with any other class of electrical equipment, is with the consumer. Defects that are not noticeable in the laboratory are often very pronounced in the home. Efficiency tests, dielectric tests and others can be better made in the laboratory, but it is the "home test" that will give true value and reliability.

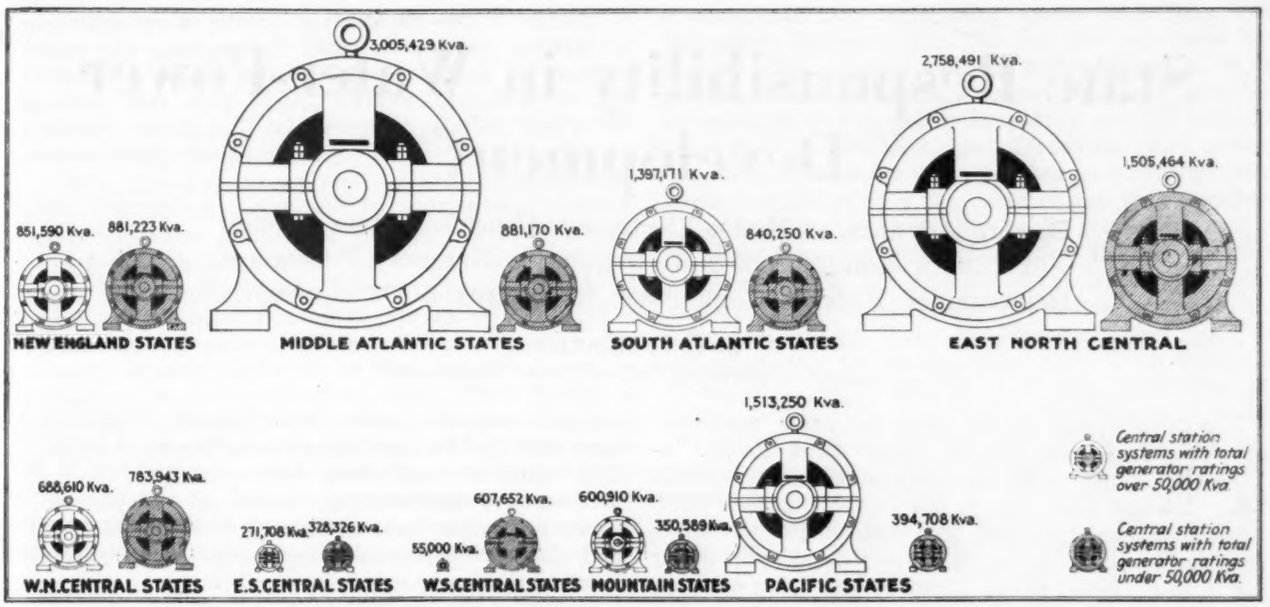
If manufacturers would "season" their appliances before placing them on the market, it would eliminate many petty difficulties. The central-station company, jobber and dealer should also try these appliances themselves before making sales on an extensive scale. Look for the bad points; the good ones will take care of themselves. See if the device can be easily repaired.

Great improvements can be made in issuing better instruction sheets with appliances, especially washers and ranges. More detail should be given as to the care of the device. Some instruction sheets supplied with washers never mention the subject of lubrication in any way. These sheets should be in better form, more attractive and furnished in duplicate.

Thousands and thousands of dollars have been spent and are being spent to educate the public to use appliances, and from my experience I believe that considerable effort should be put into education to show the public how to care for these appliances. Such an effort would help every branch of the industry directly. The object can be accomplished by better instruction data when the device is sold, this information coming from the manufacturer. The central station could assist by sending its customers a small pamphlet on the subject of care of appliances in general. The customer would then have information from two independent sources.

Central-Station Systems Grouped in Accordance with Total Rating of Installed Electric Generators—Oct. 1, 1922

Sections and States	Cos. Operating Generating Plants	Total Rating of Generators, Kva.	Systems Under 50 Kva.		Systems From 51 to 100 Kva.		Systems From 100 to 250 Kva.		Systems From 251 to 500 Kva.		Systems From 501 to 1,000 Kva.		Systems From 1,001 to 2,500 Kva.		Systems From 2,501 to 10,000 Kva.		Systems From 10,001 to 25,000 Kva.		Systems From 25,001 to 50,000 Kva.		Systems Over 50,000 Kva.	
			No. Cos.	Total Generator Rating	No. Cos.	Total Generator Rating	No. Cos.	Total Generator Rating	No. Cos.	Total Generator Rating	No. Cos.	Total Generator Rating	No. Cos.	Total Generator Rating	No. Cos.	Total Generator Rating	No. Cos.	Total Generator Rating	No. Cos.	Total Generator Rating	No. Cos.	Total Generator Rating
United States	4,489	17,715,484	638	20,554	664	52,308	1,064	188,343	707	260,361	440	321,481	410	672,740	314	1,625,226	127	2,001,591	44	1,430,721	81	11,142,159
New England	255	1,732,813	14	492	22	1,820	32	6,114	37	13,991	37	28,909	42	66,978	36	183,546	18	278,960	9	300,413	8	851,590
Middle Atlantic	457	3,886,599	32	1,047	41	3,422	87	15,154	81	28,437	66	46,962	62	100,341	45	230,589	20	327,998	4	127,220	19	3,005,429
South Atlantic	532	2,237,421	54	1,717	79	6,321	146	25,553	85	31,538	51	38,546	39	65,306	43	230,602	18	261,617	6	179,050	11	1,397,171
East North Central	866	4,263,955	106	3,326	129	10,237	187	33,852	146	55,357	86	60,243	80	128,643	73	398,911	31	486,665	10	328,230	18	2,758,491
West North Central	1,101	1,472,553	253	8,240	175	13,425	281	49,280	166	59,600	81	58,655	79	128,855	46	226,747	10	144,530	3	94,611	7	688,610
East South Central	314	600,034	44	1,331	71	5,645	73	12,775	58	21,076	20	14,830	17	30,327	21	94,159	6	101,850	1	46,333	3	271,708
West South Central	524	662,652	80	2,651	84	6,578	164	29,070	74	26,787	48	34,400	39	64,143	17	94,397	13	212,632	4	136,994	1	55,000
Mountain	266	951,499	34	1,142	37	2,100	68	12,040	43	16,901	30	22,395	28	45,608	12	64,926	6	102,207	3	82,670	5	600,910
Pacific	174	1,907,958	21	608	26	2,160	26	4,505	17	6,674	21	16,541	24	42,539	21	101,349	5	85,132	4	135,200	9	1,513,250
New England																						
Maine	53	142,129	6	225	7	591	13	2,263	8	3,090	8	6,446	1	1,250	6	28,304	3	52,662	1	47,298	0	0
New Hampshire	44	79,121	2	56	7	583	6	1,155	10	3,868	8	6,160	7	12,582	2	6,312	1	14,375	1	34,030	0	0
Vermont	50	123,335	2	20	5	399	4	840	12	4,401	8	5,475	11	16,197	5	35,528	2	25,475	1	35,000	0	0
Massachusetts	67	914,361	3	141	1	100	6	1,206	6	2,288	7	5,948	13	20,855	15	78,584	8	132,474	2	55,675	6	617,090
Rhode Island	6	215,425	0	0	0	0	0	0	0	0	1	1,000	1	1,950	2	6,875	0	0	1	43,100	1	162,500
Connecticut	35	258,442	1	50	2	147	3	650	1	344	5	3,880	9	14,144	6	27,943	4	53,974	3	85,310	1	72,000
Middle Atlantic																						
New York	233	1,985,117	22	713	20	1,681	56	9,697	32	11,970	27	19,294	34	57,137	23	115,017	8	136,025	2	63,095	9	1,570,488
New Jersey	47	348,467	3	105	5	357	7	1,287	12	4,401	7	4,924	5	7,055	6	29,122	1	10,416	0	0	1	290,800
Pennsylvania	177	1,553,015	7	229	16	1,384	24	4,170	37	12,066	32	22,744	23	36,149	16	86,450	11	181,557	2	64,125	9	1,144,141
South Atlantic																						
Delaware	10	35,287	0	0	0	0	6	1,100	0	0	1	562	1	2,400	1	3,225	0	0	1	28,000	0	0
Maryland	36	278,834	6	189	5	451	12	2,115	3	862	3	1,917	2	3,150	2	10,400	2	21,500	0	0	1	238,250
Dist. of Columbia	2	91,850	0	0	0	0	0	0	0	0	0	0	0	0	1	4,850	0	0	0	0	1	87,000
Virginia	80	243,216	11	300	7	544	21	3,508	14	5,245	9	6,957	3	4,575	11	62,187	2	29,625	0	0	2	130,275
West Virginia	52	449,612	4	129	6	490	9	1,654	9	3,547	6	4,347	3	4,735	6	33,437	3	35,570	2	55,175	4	310,528
North Carolina	89	177,909	6	216	17	1,371	25	4,361	13	4,792	9	7,512	11	19,226	6	34,131	0	0	1	30,000	1	76,300
South Carolina	67	453,873	6	262	12	1,078	18	2,916	11	4,163	2	1,562	6	11,180	7	36,725	3	38,862	1	25,625	1	331,500
Georgia	120	392,140	11	318	22	1,688	34	6,140	24	8,832	12	8,662	5	8,285	6	32,272	4	62,375	1	40,250	1	223,318
Florida	76	114,700	10	303	10	699	21	3,759	11	4,097	9	7,027	8	11,755	3	13,375	4	73,685	0	0	0	0
East North Central																						
Ohio	175	1,278,441	12	382	18	1,405	39	6,653	30	11,123	26	19,100	10	17,999	24	142,614	6	97,750	1	27,000	9	954,415
Indiana	127	425,638	14	489	14	1,029	18	4,462	23	8,635	15	10,377	17	27,233	14	80,658	8	126,975	3	102,780	1	63,000
Illinois	196	1,210,241	32	928	31	2,493	39	6,986	35	13,663	16	11,458	19	28,425	11	61,745	7	117,185	4	144,100	2	823,258
Michigan	181	812,028	18	583	28	2,204	46	8,194	31	11,295	18	11,766	19	30,638	16	73,242	2	31,200	0	0	3	642,900
Wisconsin	187	537,607	30	944	38	3,106	45	7,557	27	10,641	11	7,542	15	24,348	8	40,652	8	113,555	2	54,350	3	274,912
West North Central																						
Minnesota	153	349,162	28	918	19	1,517	45	7,987	20	7,700	11	7,815	12	19,518	11	62,202	5	62,305	0	0	2	179,200
Iowa	160	352,112	13	442	20	1,589	39	7,296	30	11,512	22	14,707	16	24,805	16	77,055	1	11,875	2	63,831	1	139,000
Missouri	179	435,230	44	1,429	27	2,083	46	8,154	24	8,426	12	9,476	17	28,219	3	14,683	3	45,350	0	0	3	317,410
North Dakota	123	27,062	55	1,788	23	1,813	24	3,739	10	3,580	4	2,842	6	9,175	1	4,125	0	0	0	0	0	0
South Dakota	95	39,320	28	815	21	1,518	20	3,345	9	3,346	10	7,559	4	5,762	3	16,975	0	0	0	0	0	0
Nebraska	195	120,088	53	1,715	35	2,660	49	8,380	34	11,490	9	7,187	9	13,886	5	21,770	0	0	0	0	1	53,000
Kansas	196	149,579	32	1,133	30	2,245	58	10,379	39	13,546	13	9,069	15	27,490	7	29,937	1	25,000	1	30,780	0	0
East South Central																						
Kentucky	91	127,220	23	647	23	1,810	18	3,115	12	3,979	2	1,590	5	9,562	6	27,142	1	20,000	0	0	1	59,375
Tennessee	84	208,420	13	456	13	1,037	16	2,516	20	7,614	8	5,626	4	7,233	5	22,855	3	56,250	1	46,333	1	58,500
Alabama	56	215,633	5	148	11	935	12	1,917	11	3,648	7	5,427	3	4,700	4	19,425	2	25,600	0	0	1	153,833
Mississippi	83	48,761	3	80	24	1,863	27	5,227	15	5,835	3	2,187	5	8,832	6	24,737	0	0	0	0	0	0
West South Central																						
Arkansas	79	79,824	12	468	14	1,071	23	4,559	8	2,855	9	5,868	7	11,685	5	35,068	1	18,250	0	0	0	0
Louisiana	68	97,798	10	335	15	1,208	20	3,555	11	4,008	3	1,812	4	7,755	3	18,925	1	13,700	1	46,500	0	0
Oklahoma	132	136,267	18	536	17	1,275	44	7,724	22	7,641	14	10,014	10	17,185	3	18,200	3	48,573	1	25,119	0	0
Texas	245	348,763	40	1,312	38	3,024	77	13,232	33	12,283	22	16,706	18	27,518	6	22,204	8	132,109	2	65,375	1	55,000
Mountain																						
Montana	46	410 051	12	425	10	649	6	1,059	7	2,891	4	2,977	3	5,050	1	3,000	0	0	1	30,000	2	364,000
Idaho	30	165,423	5	178	2	162	8	1,349	4	1,675	4	3,290	5	8,059	0	0	0	0	0	0	2	150,710
Wyoming	38	32,890	4	102	9	693	8	1,480	4	1,635	7	4,802	3	5,200	2	6,036	1	12,942	0	0	0	0
Colorado	63	153,029	5	167	6	439	24	4,338	10	4,039	2	1,290	8	13,331	3	21,000	3	55,795	2	52,670	0	0
New Mexico	28	12,469	4	100	2	155	7	1,174	9	3,282	3	2,465	3	5,293	0	0	0	0	0	0	0	0
Arizona	24	64,230	3	120	1	75	3	502	4	1,412	6	4,921	1	1,300	4	22,390	2	33,510	0	0	0	0
Utah	29	99,902	1	50	7	527	10	1,763	3	1,087	3	2,025	3	3,750	1	4,500	0	0	0	0	1	86,200
Nevada	8	13,505	0	0	0	0	2	375	2	880	1	625	2	3,625	1	8,000	0	0	0	0	0	0
Pacific																						
Washington	68	426,038	8	243	14	1,173	6	1,073	6	2,413	8	6,657	11	21,424	10	44,805	2	32,000	0	0	3	316,250
Oregon	54	180,417	8	155	7	606	13	2,145	5	1,856	7	5,499	5	7,012	6	29,324	1	10,070	1	29,000	1	94,750
California	52	1,301,503	5	210	5	381	7	1,287	6	2,405	6	4,385	8	14,103	5	27,220	2	43,062	3	106,200	5	1,102,250



IN THE PACIFIC AND MIDDLE ATLANTIC STATES ONLY A VERY SMALL PROPORTION OF THE GENERATING SYSTEMS HAVE A TOTAL GENERATOR RATING UNDER 50,000 KVA.

Eighty-one Generating Systems of Over 50,000 Kva. Rating

More than 85 per Cent of the Installed Generator Rating Is Operated by Systems with a Total Generator Rating of Over 5,000 Kva.

A STUDY of the data contained in the 1923 issue of the McGraw Central Station Directory and Data Book brings out the recent rapid growth of the super-power generating plant and the consequent elimination of large numbers of small inefficient generating plants. It was only about sixteen years ago that the total rating of systems with a generator rating under 5,000 kw. was 1,524,000 kw., or 30 per cent of the total generator rating of the country. On Oct. 1, 1922, the rating of such systems had increased only to 2,130,000 kw., while the percentage decreased to 15 per cent of the total. Records available indicate that in 1907 there was not a system with a total rating of more than 50,000 kva., whereas on Oct. 1, 1922, there were eighty-one such companies, representing a combined rating of 11,142,159 kva., or about 63 per cent of the total rating of the country.

The accompanying tabulation gives the central-station systems grouped in accordance with the total rating of installed generators. This tabulation indicates that there are 4,489 companies in the United States operating one or more generating plants with a total rating on Oct. 1, 1922, of 17,715,484 kva. There are 5,974 operating companies in the country, indicating that of this number 1,485, or 24.9 per cent, purchase all of the electrical energy which they distribute to consumers.

The results of a study of generator activity indicate that the total generator rating necessary to take care of the aggregate average load of the United States totals about 12,170,000 kva. and that the generator rating necessary to take care of the present aggregate maximum peak loads of the country totals 16,020,000 kva. The generator rating of the country in excess of the aggregate maximum peak load of the country totals 4,430,000 kva. The indications are, therefore, that 8,280,000 kva., or 40.5 of the total generator rating of the country, is in reserve for peak or emergency conditions, is temporarily out of service for repair or is idle because of some other cause.

New Zealand Has 4,000,000 Potential Hydro-Electric Horsepower

ESTIMATES of the amount of available water power in New Zealand forwarded to the Department of Commerce by Vice-Consul J. C. Hudson show a total of 4,076,700 hp., of which 759,700 hp. is in the North and 3,317,000 in the South Island. In the distribution of power resources the South Island is in an advantageous position as the bulk of its potential supply is near the deep-water sounds of the west coast, where there are many sites suitable for electrochemical and electrometallurgical industries.

A program for water-power development has been laid out in which the important sites of the North Island will be utilized. These include Lake Waikaremoana, which has sufficient storage capacity to run the proposed generating plant for twenty-one months without rainfall, and the Waikato River project, which tops Lake Taupo. The first installment will involve an estimated expenditure of £15,000,000 for the headworks, plant and transmission line to Auckland, and will develop 50,000 hp. of the 138,000 hp. which it is estimated can be ultimately obtained.

State commitments up to the end of 1923 for the Lake Waikaremoana project amount to £110,000. By the end of 1924 it is planned to spend £1,075,000, when it is expected that 24,000 hp. will be available from this source. The method of financing hydro-electric development in New Zealand is chiefly through state aid, no projects of importance being promoted by private organization. The Southland province, with some assistance from the state, is carrying on its development through a local body, the Southland Power Board.

State Responsibility in Water-Power Development*

Despite Advance of Hydro-Electricity, Unsettled State Policies and Chaotic Condition of State Regulation Handicap Progress—Relations of Federal Commission to Industrial Developments

By O. C. MERRILL
Executive Secretary Federal Power Commission

ACCORDING to the best estimates available, there was approximately 9,000,000 hp. installed in all the water-power plants, electric and otherwise, in the United States in 1920. Since that time there have been completed or put under construction under authority of the federal water-power act alone projects totaling 2,500,000 hp. Some of these, of course, will take several more years to complete, but it can safely be said that we are now in the period of the greatest water-power development we have ever known. The possibilities of the near future are indicated by the fact that applications have been filed with the Federal Power Commission for projects involving the installation of 21,500,000 hp. and that permits and licenses have been issued for an aggregate of 7,000,000 hp. Notable work has also been done in the field of transmission. Only four gaps, with a total of about 25 miles, require to be closed in order to have an interconnected transmission system along the Pacific Coast from Canada to Mexico, a distance of about 1,400 miles. It is not improbable that within ten years, if certain interstate problems are settled, similar interconnections will have been made through Idaho, Montana, Utah, Colorado and Arizona, with junctions at each end with the Pacific Coast lines, giving an interconnected circuit of more than 3,000 miles. In the South Atlantic States interconnection has been effected through Alabama, Georgia, North and South Carolina and Tennessee and will in the near future be extended into Kentucky, the Virginias and Ohio. It is only a matter of time, and that not far distant, when through the natural expansion of adjacent local groups of plants and lines we should have in the eastern United States a superpower system rivaling that of the Pacific Coast.

HARMONIOUS ACTION NEEDED

There is need of harmonious action, however, between the nation and the states, and between state and state, not only in matters of water-power development but in the whole field of public utility relations.

I have told you that under the federal law 2,500,000 hp. is already built or building. You do not need to be told how little, outside of the reconstruction at Niagara, has been built or started in New York under that law or otherwise in the last three years, notwithstanding the fact that applications for millions of horsepower have been filed before your commission and ours affecting streams within this state or on its boundaries, and notwithstanding the probability that a use could be found for the power as fast as it could be developed. While it is true that the major sites applied for are on an international stream, requiring an international agreement before development can proceed—a situation that would of itself mean delay—the problem is unnecessarily complicated by the lack of any fixed state policy respecting the development of its water powers, and until such a policy has been established no development of consequence can be expected.

PERMANENT STATE POLICIES NEEDED

The determination of such a policy is a responsibility of the people of this state. The Federal Power Commission, out of the interest which it has in power development and with its appreciation of the desirability of common action, may recommend a course which it believes should be pursued, and it will, of course, exercise such authority as it has to protect, if necessary, the common interest of all the states; but it is too thoroughly convinced of the desirability of the maintenance of state sovereignty within its legitimate sphere, and of the exercise of individual state responsibility, to have any intention of dictating a domestic policy for this or any other state.

Differences of opinion, as you are well aware, have arisen between the State of New York and the Federal Power Commission respecting the ultimate limit of the authority of the state and of the nation over navigable waters and in international streams. The commission has certain views of its own powers in the premises, as has also the State of New York. It happens that the respective powers thus viewed overlap to a certain degree. But the possession of a power and its exercise are quite different matters. The commission's unquestioned duties are of such magnitude that it would not be inclined to assume others which the states have the authority and the disposition to perform, even if the letter and spirit of the federal water-power act did not call for co-operative rather than independent action. There are no differences of opinion between the commission and the State of New York which need be an obstacle in the consideration of any particular case or which would justify the failure of either to co-operate with the other, if the state had a settled policy and was ready to proceed.

New York, however, is not the only state with an unsettled policy. Arizona presented to the Federal Power Commission only a few days ago a proposed new policy diametrically opposed to what it has hitherto pursued, a policy having no apparent hope of success, but serving to delay the state's own development and to prolong its conflict with its neighbors. California, with electric systems among the best equipped, best managed and best regulated in the United States, and with the cheapest and most abundant energy supply,

*Abstract of address given before the Empire State Gas and Electric Association, Lake Placid, Oct. 8, 1923.

went through an expensive campaign only a year ago to defeat the proposals of those who would reverse the established policy and risk the wrecking of existing systems that they might embark the state on the troubled seas of political ownership. Other similar examples might also be cited.

These divergent views and unsettled policies have reference almost exclusively to water-power development, for water powers are generally still subject to some form of public control, and they occupy a peculiar status in the public mind. They are deemed a natural resource, and there is fear lest they escape from public ownership and control. They are believed to be immensely valuable, and there is fear lest such values be capitalized for rate-making purposes. There is lack of knowledge concerning construction and operating costs, and the opinion is prevalent respecting both water powers and public utility service in general that there is a wide difference between the actual investment and the values claimed for rate-making purposes, that this difference is responsible for unnecessarily high rates, that public regulation has failed adequately to meet the situation, and that public ownership and operation is, in consequence, the only recourse. These objections and doubts must be frankly met and answered; for the views held, whether correct or not, have had the effect of injecting water-power development into the field of political controversy to such a degree as seriously to hinder present development and to endanger, if prolonged, any comprehensive program of future development.

PUBLIC INTERESTS SAFEGUARDED

That water powers are a natural resource, and that whenever owned or controlled by public agencies that ownership and control should be permanently retained, is a fundamental principle of the federal policy. It should be equally a principle of state policy to the full extent that the states have ownership or control, either concurrently with or independently of the federal government. It is a principle, furthermore, to which you gentlemen of the industry should freely subscribe. All that you need ask is that the control be intelligently exercised.

The principle that values inherent in a public resource developed and used in the performance of an essential public service by an agency created by law for that purpose shall not be capitalized in excess of amounts actually expended in acquisition is likewise a fundamental feature of the federal policy, applicable in all cases where power sites are licensed under the federal law. Furthermore, this principle applies not only to the site itself, but to all structures and equipment erected or used on the site or in connection with it. Whether our water powers have great values or not, the public fear that their values will be capitalized at the expense of the ratepayer is groundless as far as sites under federal ownership or control are concerned, and these sites involve 85 per cent of the total water powers of the United States. This provision of the federal law is not hindering in any degree the financing and construction of water powers under federal control, and a similar provision would not hinder the development of the remaining 15 per cent subject to exclusive state control. This is a policy on which all, the utilities included, can well agree and thus remove it from the field of controversy.

It is argued, however, that there are other properties involved and that their value rather than their cost determines the rate base. The fact that such basis has legal sanction, coupled with the belief that there is, in general, a wide and undue disparity between actual investment in electric utility properties and the amounts allowed as the rate base, has afforded the chief ground for the complaint, whether justified or otherwise, that public regulation does not regulate and that therefore it is necessary to substitute public ownership. It is doubtless true that public regulation has not met with full success. It has failed adequately to protect the public in some instances and adequately to protect the utility in others. There has, however, been too little honest attempt to give it a fair trial. Until there has developed a public opinion which will insist that our public service commissions be chosen because of fitness for the task rather than political affiliations, that they shall be as unhampered in their operations as our courts, we cannot expect to have continuity of policy or to reach an intelligent solution of the perplexing problems of public utility regulation. The remedy, however, is not to discard regulation but to strengthen it. Make it honest, make it effective, make it fair. When we shall have done this there will be no valid reason remaining why we should abandon in the field of power development that course which has been responsible for our whole industrial structure—reliance on the driving power of private initiative.

MISINFORMATION RESPONSIBLE

To no inconsiderable degree the attitude toward water-power development which I have discussed is due to lack of correct information, particularly with respect to costs of construction and of operation. Many people do not realize that when the hydro-electric plant is erected less than half of the cost of the combined generating, transmission and distributing system has been incurred. Still fewer people realize that from 70 to 90 per cent of the costs of delivering the electricity to the resident consumer is incurred after the power has left the generating station. You gentlemen of the industry have this information. You should give it full publicity, without concealment and without bias, and should co-operate with all public agencies in its dissemination. We cannot expect to develop a wise public policy or to secure its general acceptance without the support of an informed public opinion. We should, therefore, use every legitimate means to present the facts and the essential economic principles involved in power development, distribution and utilization. When the full truth is known and recognized as such, the field of controversy will be materially narrowed, even if it does not altogether disappear.

OTHER PROBLEMS ALSO TO BE SOLVED

I have laid stress on the water-power problem and the unsettled policy with respect to it which exists in many quarters because water powers form an essential part of any comprehensive superpower system and because the controversies concerning them demand early solution if we are to be free to proceed with our greater program. But there are other problems which must also be met and solved. We must first of all make it clear that we are dealing with a program far wider than the territory or the authority of any individual state and yet of vital interest to the citizens of each state. We must harmonize these interests, while at the same time developing a policy and accomplishing a program which

will be to the common interests of them all. This will require co-operative action and reasonable uniformity of legislation. There must be no state barriers against the interchange of energy and no type of development that cannot become an integral operating part of the combined system.

If we are to accomplish our purpose, we must have ourselves a positive program around which we may rally all those who are honestly seeking development in the common public interest. With respect to water power, the principles of the federal policy as contained in the federal water-power act may well form the basis of such a program. I do not suggest this just because it is a federal policy, but because it is a policy which has been tested by experience and which is producing results. Capital has no difficulty in meeting the terms of the law and its provisions afford protection to every legitimate public interest. With state legislation and state policy in reasonable conformity with federal law and policy, and with that full co-operation between state and nation which it is the purpose of the Federal Power Commission to promote and maintain, the obstacles now existing to water-power development would disappear.

PUT REGULATION ON A PERMANENT BASIS

These same principles are equally applicable in the general field of electric utility operation and regulation, and we should strive to bring about in this field also reasonable uniformity of policy and of legislation. Above all, we should seek to place the principle of public utility regulation on a sound, consistent, permanent basis, wholly divorced from every consideration of partisan politics. Rate and service regulation is now and should continue to be a state function. When the program we have in view has developed there may arise questions requiring adjustment between the states. If so, I would suggest that they may best be handled by direct negotiation between the states in accordance with the precedent recently established with respect to the Colorado River, where seven states, through their appointed representatives, have negotiated a compact covering the allocation of the waters of that river.

Finally, there is the problem of harmonizing the various interests within the industry itself. It should no longer be possible for any utility to draw plans for future extension except in such manner that interconnections may be readily effected whenever its territory merges with the territory of any other utility. There is still too much of a tendency for each individual group to approach the problem of interconnection solely from the viewpoint of its own immediate interest, overlooking its own future interest, ignoring the general advantage to the industry as a whole, and forgetting that, as a quasi-public agent performing an essential public service, it has a public duty to perform for which it will be held accountable.

There will be no more important factor in our future industrial development than cheap and abundant electrical energy. Few other factors have more important social relations or give greater promise, by the progressive substitution of mechanical for manual labor, of raising the economic level and improving the social status of the great masses of the people. To promote means whereby these results may be accomplished should be worthy of the best endeavors of us all. It is a combined financial, administrative and governmental problem. We should unite all forces in its solution, in the spirit of co-operation, seeking the common good of all, even though it may sometimes require the partial submergence of individual interests.

Radio Signals for Coast Protection

A RADIO fog signal has been installed in the new light vessel on Nantucket Shoals, one of the most important lightship stations in the world as well as one of the most exposed, since it is anchored 41 miles from land. This signal will be operated by an automatic apparatus sending during fog a group of four dashes every thirty seconds and thus enabling vessels equipped with radio direction finders to obtain an accurate bearing from a distance of 30 miles or more in any weather conditions and to steer for and "make" the lightship. In addition, a powerful electrically operated signal is to be substituted for a submarine bell hitherto employed. This signal will be of 3,000 cp. and will show at the masthead four occultations a minute. The Nantucket Shoals installation is the eighth radio fog signal thus far put into commission, and five more are being established. Ten of the thirteen are on lightships. Nine are on the Atlantic Coast and four on the Pacific.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Control Problems with High-Voltage Networks

To the Editors of the ELECTRICAL WORLD:

I note your editorial of Sept. 8 on "Growth of High-Voltage Networks Introduces Control Problems." The answer to most of the points raised was given in my paper "Voltage Regulation and Insulation for Large-Power, Long-Distance Transmission Systems" (A. I. E. E., June, 1921). The answer is also given in the "Atlas of U. S. A. Electric Power Industry," page 15 and plates XV and XVI.

In such a system of constant-potential transmission the generating stations supply the kilowatt-hours or the energy kva. of the system, and the synchronous condensers supply the wattless kva. to control the voltage of the system. This necessarily gives a constant-voltage system stabilized inherently by the condensers. This is the only way that I can see in which we can get the large-capacity transmission systems required for the solution of the power problems of the United States.

But to get the large capacity per circuit required, it is necessary that for the main transmission system the operating voltage be around 220 kv., and I proposed 220 kv. as standard for the high-power transmission lines of the nation. At this voltage the charging kva. becomes a very valuable asset and gives a transmission with a natural capacity of 120,000 kw. per circuit and a full-load capacity of 150,000 kw. to 200,000 kw.

I believe engineers should study the proposed system. They will be surprised at its simplicity and flexibility and by the method of calculating transmission. The need for such a system is becoming apparent to engineers.

F. G. BAUM,
Consulting Engineer

San Francisco, Cal.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Method of Locating Faults in Buried Lead-Covered Cables

By H. S. Baker
Meter Department, Ontario Power Company, Niagara Falls, Canada

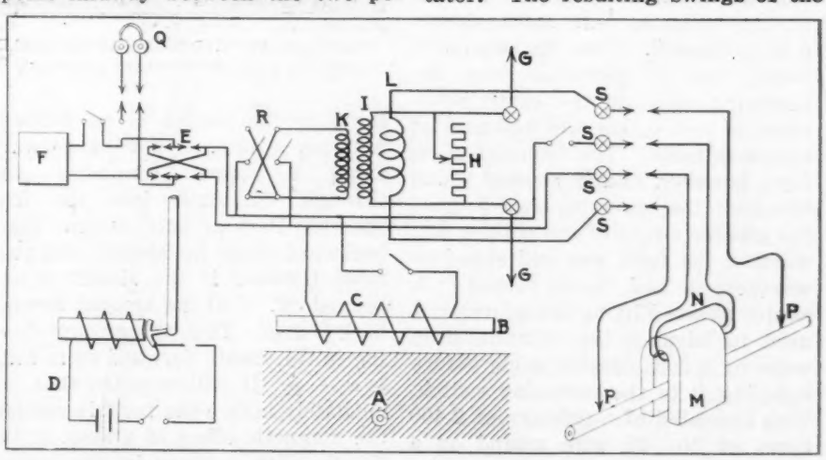
THE method of locating cable faults here described is an adaptation of the "hetero-galvanometer" described by P. A. Borden in a paper on "Balance Methods in Alternating-Current Measurement," presented at the A. I. E. E. Convention at New York in February, 1923. The hetero-galvanometer is essentially a direct-current voltmeter or ammeter with rectified alternating current applied to it in which the commutator frequency is somewhat above or below that of the alternating current to be detected. In operation the meter makes periodic swings whose amplitude is an indication of the alternating current or voltage to be measured and whose rate of swinging is a measure of the difference of frequency between the alternating-current source and the rate of commutation. This method utilizes the direct-current permanent type of instrument, which gives a scale that is uniform right down to zero and whose sensitivity to very small voltages far exceeds that of the alternating-current styles of instruments.

The cable system on which the method was developed and used was a four-wire, three-phase, 4,000-volt, 25-cycle feeder in which all cables were buried about 18 in. in the ground and the lead sheath was in direct contact with the soil. The neutral was dead-grounded, thus making all conductors 2,300 volts from ground potential. Three separate single-conductor cables of No. 6 copper with a lead sheath about $\frac{5}{8}$ in. in diameter were buried in one trench. The feeder was about 10 miles long in sections of 1 mile to 3 miles each.

The cable fault-finding device takes cognizance of two elements, namely, (1) the magnetic field of the artificial 25-cycle current being fed into the fault, and (2) the potential drop between test points inserted into the earth near the cable and some distance apart along the cable. Both effects are communicated simultaneously to the direct-current millivoltmeter by a commutator whose frequency is somewhat different from the main 25 cycles of the alternating current. A reading of the swing is taken, and then one of the effects is reversed by a reversing switch, and another reading is taken. The direction of throw of the reversing switch giving the larger reading is an indication of whether the fault is farther from the source of power or nearer to it than the point midway between the two potential test points inserted in the ground.

A very simple form of commutator was employed, which was energized by a single dry battery. A make-and-break vibrator on the principle of an electric bell caused a shaft to oscillate at a rate adjustable in the neighborhood of 25 cycles per second. This oscillating shaft operated four contacts, of which each was alternately closed for about a half cycle and open for about a half cycle, two of them being closed when the other two were open.

The magnetic-field detector consisted of a coil of about 1,600 turns of No. 28 wire wound near the middle of a laminated bar about 30 in. x 1 in. x $\frac{1}{2}$ in. The bar was placed on the ground crosswise of the cable, and every alternate half cycle of its coil voltage was applied to the direct-current millivoltmeter through one contact of the asynchronous commutator. The resulting swings of the



SCHEMATIC ARRANGEMENT OF APPARATUS FOR BURIED CABLE FAULT LOCATOR

A—Cable buried in ground.
B—Laminated iron bar.
C—Winding, 1,600 turns No. 28 wire.
D—Vibrator, adjustable in speed, in neighborhood of 25 cycles.
E—Asynchronous commutator operated by motion of vibrator.
F—Permanent magnet type of direct-current voltmeter. 0.62 volts full scale and 62 ohms resistance.
G, G—Contact points inserted in ground near cable at points, say, 100 ft. apart along cable.
H—Variable resistance to reduce value of potential drop effect to a value comparable with the magnetic effect received from bar *B*.
I, K, L—Three-coil transformer with air gap in iron. Iron $\frac{1}{2}$ in. x 3 in. section.
I—2,400 turns No. 28 wire.
K—1,600 turns No. 28 wire.
L—50 turns No. 14 wire.
M—"U"-Shaped core $\frac{1}{2}$ in. x 3 in. to slip over exposed cable.
N—1,600 turns No. 28 wire.
O—Exposed cable (when exposed cable test is made).
P, P—Potential taps on sheath of exposed cable, about 1 ft. apart.
Q—Head phones used in locating position of buried cable by detecting the influence of cable *A* on bar *B*. The current from coil *C* passes intermittently through contacts *E* to phone *Q*. The varying position of bar *B* in regard to cable *A* gives varying sound in head phones.
R—Reversing switch used to vectorially add or subtract the potential effect received through *G* or *P* from the current effect received through cores *B* or *M* respectively.
S, S—Terminals used only in the exposed cable test.

needle gave an indication of the net amperes flowing beneath the bar. Part of this was artificial fault current, part was return fault current along the lead sheath, and part was load current in other cables in the same trench. It will be shown later that there is no sudden change in the vector sum of conductor fault current with sheath return current, as the point of fault is passed in moving along the cable. This is why it is in practice necessary to take cognizance of potential drop also. About a quarter-inch total swing was produced by a 7-amp. artificial fault current at 1½ ft. below the bar.

Operation of Fault-Locating Testing Apparatus

The potential between two test spikes driven in the ground a hundred feet or so apart along the cable was first passed through a reversing switch and then through the remaining contact on the asynchronous commutator and applied to the direct-current millivoltmeter during the half cycles that the magnetic effect was not applied to it. With the magnetic coil disconnected, the swings of the pointer gave an indication of potential difference between test spikes. It was noted that a spike ¾ in. in diameter and 18 in. in the soil gave about twenty times as strong action as ¼-in. spikes driven 6 in. in the soil. Thus the amount of swing due to potential drop depended greatly on the earth resistance at test spikes and nearness of spikes to cable. The required readings, however, clearly showed which throw of the reversing switch gave the greater swing of the pointer and whether the fault was still ahead or whether it had been passed. A simple phase-shifting transformer is used to advance the potential-drop wave by a considerable angle before applying it to the reversing switch. This consisted of a primary of 2,400 turns of No. 28 wire wound on a laminated bar 12 in. x 3 in. x ½ in. A secondary of 1,600 turns of No. 28 wire fed the reversing switch.

Resistor for Test Current

A 2,200-volt, 7-amp. resistor was built to feed artificial current into the fault. It was about 3 ft. x 5 ft. in size, being of No. 22 "Nichrome" wire with springs to keep the wires tight as they expanded with heat.

If the load currents in adjacent cables bring the net magnetic effect into approximate step with the potential drop between test spikes, it is better to omit the phase-shifting transformer, because if the two effects reaching the device are in quadrature, their vector difference and vector sum are equal and no difference of readings upon throwing the reversing switch will be obtained.

The reason for there being no sudden change in magnetic effect as

PRACTICAL METHOD OF LOCATING CABLE FAULTS USED BY ONTARIO COMPANY

the fault is passed is as follows: Suppose x amp. is flowing forward along a copper conductor and through the fault into the lead sheath. Part of this current flows backward along the sheath, and part flows forward if the sheath is not burned off. Call the amount flowing back y amp. Then the amount flowing in the sheath forward from fault is $x - y$. It will be noted that immediately before the fault is reached the magnetic effect of y amp. in the sheath with x amp. in the copper gives the same value, $x - y$ amp., producing magnetic fields above ground.

Of course, at points a considerable distance from the fault the sheath currents are not these values because a part of the current has spread out into the soil. In the case of the lead sheath being burned off and the fault current taking entirely to the power side of the break, the value $x - y$ becomes zero at the point of fault, and the magnetic search coil and bar must be kept at a position giving some appreciable readings on magnetic effect.

The above-described test is made without digging to expose the faulty cable and is a saving of labor in long sections of buried cable. When, however, the fault has been bracketed to a space of, say, 150 ft., the above tests applied within this range become unreliable.

Final Test on Exposed Cable

The following test is then applied to the cable after exposing about a foot of it by digging. The small U-shaped core and coil shown in diagram replaces the long laminated bar, in the above described test, and the potential test points are applied directly to the cable sheath about a foot apart and feed the 50-turn heavy wire coil of the phase-shifting transformer. This test has proved extremely reliable and distinct up to within a few inches of the fault. Care must be taken to avoid mistaking a good cable under load for the faulty cable under test where more than one cable is buried in one trench. It is liable to save time and avoid confusion if the load is cut off all other cables in the trench with the cable under test.

Before experimenting on the use of the 25-cycle artificial fault current we tried out 750-cycle current produced by an electrically operated tuning fork carrying contacts interrupting battery direct current and using triangular coil and telephone as detector. The above system gave plenty of sound in telephone, but the sound could be heard on adjacent cables not connected at all to the source of 750 cycles. In a few cases the 750-cycle method gave fair results, but in general it proved useless.

Keeping Transformer Records

ON A LARGE system it is convenient to use a card file for keeping transformer records. The Detroit Edison Company has this system installed and has complete data on the 18,000 transformers used.

The system is flexible, easy to administer and quickly used. The card shown in Fig. 1, white for single-phase and buff for three-phase, is used with each transformer. When a transformer is received at the warehouse the date, the maker, the maker's serial number, type, form, primary and secondary voltage and the serial number of the

Detroit Edison Company, as indicated by Fig. 1, are placed in the space at the bottom of the card. If installed on the system, a record is made on the card, starting at the bottom column. Another card (Fig. 2) is filed in the rear of the card shown in Fig. 1 and contains data as to tests, repairs, loads, location, etc., of the transformer. As in the former case, white is used for single-phase and buff for three-phase.

Complete Record Available

These two cards give the whole history of the transformer. A red tab placed on the record card (Fig. 1) indicates that the transformer is junk, but the card is held in the file. Green tabs show the pole-type series transformers and purple tabs the potential transformers. These cards are filed serially in trays which are readily accessible, and a cross-indexing system adds to the convenience of the arrangement. One cross-index (Fig. 3) is made on the basis of the serial numbers of the manufacturer and the Edison company. If a record comes in giving a serial number only, this file affords means for identification. Another cross-record file (Fig. 4) is made on basis of location and the load is put on this card file so as to have a record of each transformer that has served a given load.

Aspects of High-Pressure Steam-Plant Design

COMMENTING upon the design of equipment for the Weymouth station of the Edison Electric Illuminating Company of Boston at the recent Swampscott convention of the New England Division, N. E. L. A., I. E. Moultrop of the Boston company pointed out that the high-pressure boiler to be installed has practically the same dimensions as an ordinary boiler and occupies the same space as the latter unit in the plant layout. The drum of the high-pressure boiler (designed for 1,000-1,200 lb. operation) is to be built like a gun barrel, and it has a 3-ft. diameter shell 4 in. thick, without riveting and with swaged ends. Welded joints will be used on the high-pressure piping. The other boilers for this station will operate at 375 lb. It is noteworthy that the cost per kilowatt of a standard 375-lb. plant is about the same as that of a plant including say 1,200 lb. pressure and reheating equipment, owing to the increased capacity anticipated with the high-pressure addition. This turbine will have three stages and will drive a synchronous generator.

R. E. Dillon, assistant superintendent of the generating department, Boston Edison Company, referred to the efficiency curves presented by Moultrop and Pope in their A. I. E. E. paper on the Weymouth station (see diagram), showing the relation between efficiency and pressure without resort to reheating.

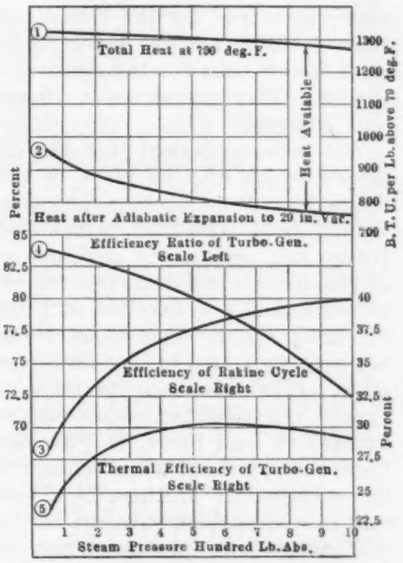
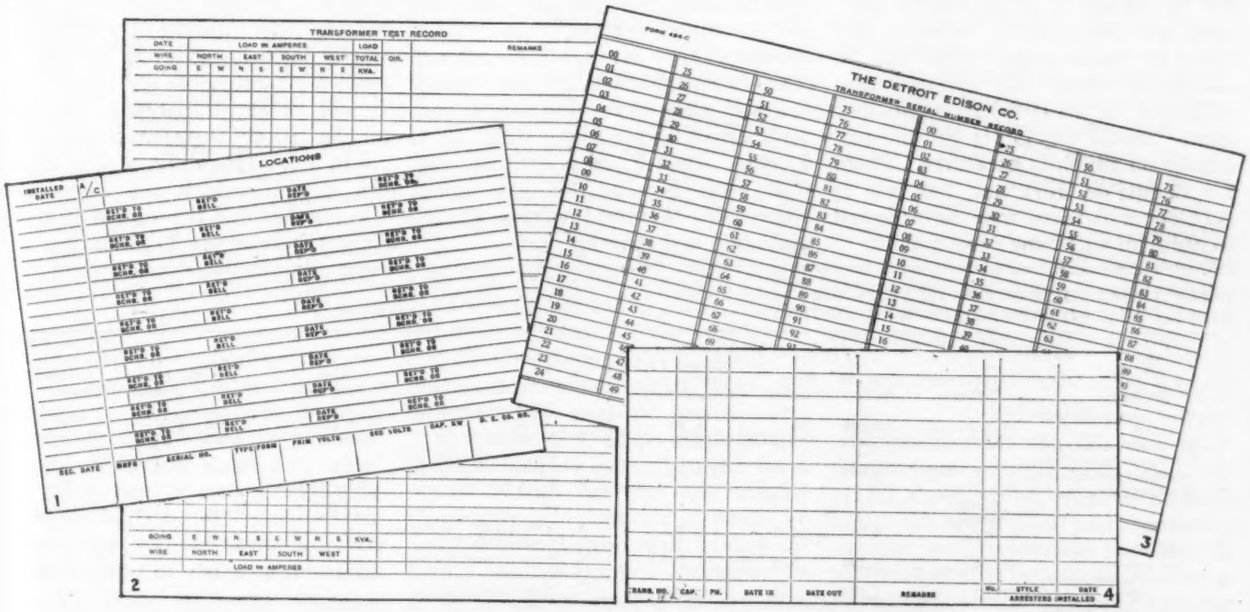


FIG. 1—EFFECT OF STEAM PRESSURE ON TURBINE THERMAL EFFICIENCY

Mr. Dillon pointed out that if curves should be drawn showing this relation with reheat, the Rankine efficiency curve would be only slightly higher than the corresponding curve No. 3 in Fig. 1 and the turbo-generator efficiency curve No. 4 would indicate that there is very little drop in efficiency throughout the pressure range. The curve corresponding to curve 5, which shows the product of the values given in the two other curves, would show a steady rise of value with pressure to a point beyond 1,200 lb. At 1,000 lb. pressure, Mr. Moultrop stated, this over-all efficiency of the turbine would contribute to a B.t.u. value per kilowatt-



TRANSFORMER RECORDS AS USED BY THE DETROIT EDISON COMPANY HAVE PROVED VERY SUCCESSFUL

This system has proved very successful and can be used to advantage by the property record department, as photostats of the trays give detailed information on all transformers, which can be readily checked.

hour net output for the reheat station of 13,600 against 15,100 B.t.u. per kilowatt-hour for the non-reheat station. This represents a 10 per cent increase.

The authors showed that the approach which may be made to this figure depends on whether the reheat station is a base-load plant. Mr. Dillon said that it is desirable to emphasize this point lest this feature be overlooked in connection with the curves of Fig. 1. The reheat design is primarily suited to base-load operation. It is difficult to control or to bypass the reheaters when sudden changes of load occur, and at such times the superheat will discharge to the condensers. If there is a base load for one turbine only, the rest of the station can probably best be served at 375 lb. pressure without reheat.

The use of high pressure in closed vessels is not a new experiment, and material and structural factors for such pressures are well developed. "We have not become accustomed to think of high temperatures in connection with high pressure, perhaps," said Mr. Dillon, "but no complications are added in this connection. The furnace temperatures to which the high-pressure boiler surface will be subjected and the fluid temperature in contact with the metal are not in excess of temperatures now used, and the additional stresses imposed at these temperatures can be adequately cared for by increased thickness of steel without causing undue strain at joints or unequal expansion which is excessive. There are details to work out, but this is nothing more than may be expected to come up with new development.

Unit Costs of Industrial Lighting Systems

THE unit costs of installing and operating several industrial lighting systems given in the accompanying tables were presented in a paper by D. H. Tuck, electrical engineer of the Holphane Glass Company, at the recent convention of the Illuminating Engineering Society at Lake George, N. Y. Mr. Tuck pointed out that the most logical and useful method of expressing the unit cost of a lighting system is in cents per foot-candle per square foot. The value of unit costs is in comparing the economy of installation and operating costs of various types of lighting and in arriving at a quick estimate of the cost of any industrial lighting installation when the area to be illuminated, the foot-candle intensity to be obtained and the type of equipment to be used are known.

The unit costs of installation for several industrial lighting installations are given in Table I. These costs were obtained from the formula $X = 100C/EA$, where X is the unit cost in cents per foot-candle per square foot, C the total cost of complete job, E calculated illumination intensity checked after installation with a portable illuminometer and A total floor area in square feet. It may be seen from the table that the cost for direct lighting of the "RLM" industrial type is roughly 2 cents, and that of semi-indirect lighting (totally inclosed globe type—indirect 69 per cent, direct 31 per cent—Item 11) is 5 cents. Item 9 has a low unit cost, 0.52 cent, because 750-watt lamps were used, thereby lowering the installation and reflector cost.

The low unit installation costs of Items 1 and 12 are due to the method of installation. In both these cases the localized general type of installation was employed, and owing to the intensive type of light distribution a high illumination intensity on the looms was received at the expense of the aisle illumination. It is to be noted that in such cases where the illumination is not uniform over the entire floor area the unit cost expressed in cents per foot-candle per square foot is in a way a misnomer, inasmuch as the foot-candles times the square feet of floor area does not give the total useful lumens. When interpreting unit costs of lighting for non-uniform systems, the nature of the work must be taken into account. This suggests possible ways of lowering the unit cost of installation by judicious engineering.

The unit operating costs for the same installations given in Table I are presented in Table II. The same formula may be used to obtain these values except that C is the total operating cost and E is the actual average intensity in foot-candles as read before and after cleaning intervals.

This table indicates that the unit costs of operation for direct illumination of the "RLM" type is roughly 1.3 cents per foot-candle per square foot and that the unit cost of semi-indirect (indirect 63 per cent, direct 31 per cent) lighting of a high-class totally inclosing globe is roughly 2.3 cents per foot-candle per square foot. It will be noted that the units cost for the "RLM" installation vary from 1.0 to 1.6. This difference is due to the way in which the installation was planned and the degree of depreciation before the illumination test.

TABLE I—UNIT COSTS OF INSTALLATION FOR VARIOUS TYPES OF INDUSTRIAL LIGHTING SYSTEMS

	Industry	Type of Reflector	Area per Sq.Ft.	Foot-Candles	Unit Costs, Cents per Foot-Candle per Square Foot
1.	Wool-yarn mule spinning*	Hol. No. 621	12,000	30	0.48
2.	Metal stamping	RLM	5,424	3.5	2.95
3.	Electric manufacture, assembly small parts	RLM	6,860	11	1.78
4.	Wool weaving	Porcelain-enam., shallow dome	4,888	11.9	2.45
5.	Knit goods—knitting machinery	RLM	3,200	5.6	1.23
6.	Soap manufacture, general	RLM	7,974	2.5	2.68
7.	Structural steel, general	Porcelain-enam., deep bowl	208,380	2	0.66
8.	Auto paint shops	Steel-enam., deep bowl	3,264	3.5	1.01
9.	Railroad repair shops.	Steel-enam., deep bowl	48,000	1.7	0.52
10.	Aluminum spinning	RLM	29,680	3.6	1.25
11.	Office coal company	Filterlite inclosing glass	5,500	3.0	5.14
12.	Silk weaving*	Hol. No. 621	12,000	30	0.50

TABLE II—UNIT COSTS OF OPERATION FOR SEVERAL INDUSTRIAL LIGHTING INSTALLATIONS

	Industry	Type Reflector	Area per Sq.Ft	Foot-Candles	Unit Costs, Cents per Foot-Candle per Square Foot
1.	Wool-yarn mule spinning*	Hol. No. 621	12,000	30	0.36
2.	Metal stamping	RLM	5,424	3.5	1.60
3.	Electric manufacture, assembly small parts	RLM	6,860	11	1.20
4.	Wool weaving	Shallow dome Porcelain enam.	4,888	11.9	1.60
5.	Knit goods—knitting machinery	RLM	3,200	5.6	1.01
6.	Soap manufacture, general	RLM	7,974	2.5	1.63
7.	Structural steel, general	Porcelain-enam., deep bowl	208,380	2	1.3
8.	Auto paint shops	Porcelain-enam., deep bowl	3,264	3.5	0.98
9.	Railroad repair shops.	Porcelain-enam., deep bowl	48,000	1.7	1.47
10.	Aluminum spinning	RLM	29,680	3.6	1.26
11.	Office coal company	Filterlite inclosing glass 69-31	5,500	3.0	2.3
12.	Silk weaving*	Hol. No. 621	12,000	30	0.45

*Localized general system of illumination. All other installations shown in tables are of the general system.

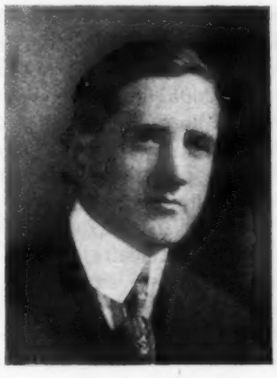
Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

How Central-Station Merchandising Affects Other Dealers

A Review of Past Policies and Trends with Suggestions as to Ways and Means of Developing Better Retail Selling Methods Throughout the Local Electrical Industry

By C. E. Greenwood
Merchandising Manager Edison Electric Illuminating Company of Boston



C. E. GREENWOOD

NO SUBJECT of central-station activity has received more marked attention during the past year than electric merchandising. The appliance business is a particularly active one because the manufacturers are continually producing in varying volume during periods of depression and periods of prosperity. The central-station company's concern in the distribution of devices varies in direct proportion to the confidence of the management in the revenue-producing value of the devices, and the policy of distribution by the management varies in accordance with franchise rights and the established relationships of other electric interests in the community.

Cycles of thought on the subject of electric appliance distribution have been marked. It is less than two decades since we had the central-station museums—otherwise known as appliance exchanges or showrooms (I do not think they are all extinct even today). Appliances were considered in the light of curiosities, but the central-station company rightly adopted them as a part of the electric home service. The commercial man saw possibilities for adding kilowatts to his lines, and the next cycle, that of appliance distribution, started. This was marked by effort in getting consumers interested in using the devices. The method employed in getting the appliances into the possession of the consumer was of minor importance, provided that the expense was justified by the return in future revenue.

Meanwhile, the manufacturer, producing in larger volume, sought that wider distribution which is essential for building all permanent business, and he started solving his wider-distribution problem by interesting a greater number of dealers, both electric and non-electric. They started in so-termed competition with the central station.

But the dealer, having as a rule poor facilities for promotion and lacking creative selling ability, found out that in communities where central-station companies followed an unethical merchandise practice, he had more of a museum than a store, with no turnover. This situation became disturbing enough to call for a Moses to lead the way out. Heated discussion and noticeable dents in central-station good will in the industry followed, but constructive principles were evolved in the end, and the cycle of appliance distribution gave way to the cycle of dealer recognition. Central-station merchandising departments were analyzed, reconstructed and re-established on a more efficient operating basis. This was a trial cycle and of value in that manufacturers, jobbers and others admitted that the central station, "the daddy of the industry," must be the leader.

We are now moving rapidly into the cycle of aggressive central-station merchandising on co-operative principles. Let us call it co-operative competition.

The central-station company is and will be the leader in the merchandising field for many years to come, because manufacturer, jobber and dealer need this active leadership. Experience in the varying cycles has taught this lesson. But the central station must do business on ethical principles and at a profit. A subsidiary company would not have the interest in the small independent firm that the central station maintains as an essential, and the dealer would have lessened opportunities. Witness the largest independent now, the department store which, is the real competitor of the small dealer. The department store has no interest in the smaller dealer or his success.

Again, the practice of any central station favoring one of a few dealers and building their business at the expense of others has caused discontent. It is authoritative opinion that more good will is lost by this practice, through arousing jealousies and animosity among the dealers themselves, than could result from occasional errors of judgment in central-station merchandise practice.

Attitude of Public Service Commission

A member of the Massachusetts Department of Public Utilities recently stated to me that he believed the public wanted our merchandising service in preference to that of others, but that no special operating advantages should be granted us that other dealers did not have. This was said in a discussion of the question of cutting off service because of unpaid appliance bills.

We shall all agree that the leading manufacturers would consider it a calamity for the central stations to

stop merchandising. A central-station outlet for their products has first consideration. This could not be had if it was general practice for the central station to cut prices on the standard lines or practice other policies destructive to competition. The manufacturer has a deep interest in the dealers, who are the vital factor in his problem of distribution. He wants no injury done to them. But he knows that when the central station is advertising vacuum cleaners, for example, his own factory agent, or the jobber, receives more small-dealer orders than at any other time. It is true in other lines. That is, the aggressive selling of an electrical device is selling the idea to the public. A wrong impression is obtained from those not intimately acquainted with the field that the central station is getting all the sales away from the dealers, but the fact is that the dealer is "cashing in" on the central-station promotion of its own business.

WHY NOT PROMOTION ONLY?

Now, others might say: "Why not, then, let the central station promote and the dealers get all the sales?" The answer is simply that the public mind does not work in a way that would make this plan the remedy for the assumed ills. If the neighborhood haberdasher advertises a hat that has a national trademark, the average man does not buy it from the small dealer, although he may want one of this brand. He goes to a better-known merchant in whom he has confidence and buys the same hat. If it were something that might get out of order and there was a guarantee to fulfill, he would positively go to his own tradesman. Does this not give the answer on the small-dealer question, and can the central station change the public's mind?

Referring to the policy of non-merchandising by the central station, attention is naturally directed to Cleveland, where the company actively co-operates with all electrical dealers but sells no appliances itself. However, the head of the promotion department of one of the best known vacuum-cleaner manufacturers in the country in a recent article made the following statement:

"The investigation which I have made in the last few months has shown me that in no community have there been so many home demonstrations for the major appliances—washers, ironers and sweepers—as there are new home meters being connected. In Cleveland I found that the home demonstrations did not equal more than 50 per cent of the homes being electrified."

Now, I venture the statement that if the Cleveland company had been in the merchandise business as well as the dealers, all would have done more than 50 per cent of demonstration on these major devices.

JOBBERS' AND DEALERS' OPINIONS

The leading jobber in Atlanta gave me the information that the greatest per capita sale on appliances in Georgia was in Athens and vicinity, where the central station was aggressively merchandising. He found that the dealers were getting along as well as in any other community.

A recognized live dealer in one of the Massachusetts cities where the central station gave up merchandising a few years ago stated to me at a recent convention that he wished that company would go into the business again. As he expressed it, the appliance business had lost its punch.

Now, these statements of different interests outside the central station are not isolated cases. I believe they are representative of sober thought based on experience. And these cases are not mentioned for the purpose of proving that central stations ought to merchandise—that is not the subject at issue—because the executives of some of the larger central stations have quite definite opinion now on the subject. The discussion thus far has been to emphasize the fact that help rather than injury results to the dealer from an aggressive merchandising policy on true cost principles. There are lamp policies and service policies existing in different communities which give the dealers and contractors far more concern than merchandising practices. I repeat this remark by a man who has been foremost in advancing the dealer cause.

Let it be assumed, then, that the present cycle is to be a constructive one, that the central-station merchandise department should be self-supporting. One of the misfortunes of this merchandise business in the past has been the slight attention paid to it by central-station executives. The particular attention which the business is receiving now and which it merits is one of the most encouraging signs of its future success. Due consideration of the needs of the merchandising business from executives, correct buying and volume sales will produce a net profit on operations, even without taking into account the factor of load building.

In some companies (Boston Edison, for example) promotion expense has always been borne by the appliance department. The work naturally falls in the sphere of that department's activities. As a good business expedient, I believe the consensus of opinion is against any allowance being made the merchandise department for load building or energy sale. This value of the department in this way is obvious and is generally recognized, but to make such an allowance is unfair to the independent dealer. There is a large field for promotion work, and expenses incurred in promotion activity ought to be kept in a separate account and due consideration be given it in merchandising operations. Our special salesmen spend a substantial portion of their time in promotion, interesting apartment-house owners to put in heating circuits and institutions to put in electric kitchens or laundries; but we sell a comparatively small percentage of the total, because, after we spread the idea, the "prospect" does some shopping and our prices are beaten. One prominent jobber sells at his cost price, many contractors sell to homes at a price necessary to get the wiring job, and the bakery-supply people secure better discounts from the manufacturer than the central station can receive and so can quote lower. But the company gets the business. How shall we charge up the expense of the merchandise department in such promotion work? I believe a special account should be opened and the amount of this expense be credited to the merchandise department.

POSSIBLE INJURY TO DEALERS

The question is often raised of injury to dealers because of the central-station company's merchandising. If the central station is carrying on its business on sound principles, injury cannot result, but rather advantages. "Competition is the life of trade" applies to our business like any other. But we have a further interest in our competitors and wish to co-operate with them.

Recognizing the fact that with the average independent dealer merchandising is a side line and that his organization is small, it follows that he has had less time to learn as much as he would wish about electrical appliances.

The central station can tell the contractor when, how and why to buy

electric appliances, and what to buy because it buys and sells big quantities and it has to find out what sells and what does not, what wears and what will not.

The central station can show the contractor how to exhibit his stock of appliances to the best advantage, how to get the most advertising for the least money. Few dealers can afford a professional display man. The central station could sell this service on an hourly basis.

The central-station company can prove to the contractor that for every sale the company has a chance to make the contractor has a better chance, because he is on the ground before the customer is connected up at all and before the company even knows there is a customer. Being first in the field, if the contractor has the right line of the right goods, he may keep the customer for life.

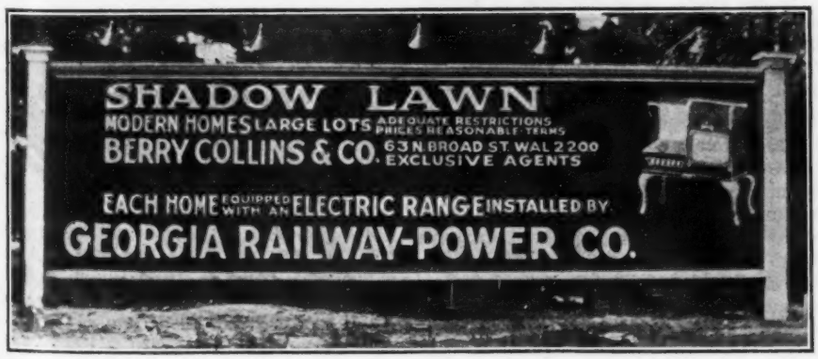
Small Power Customer's Consumption Doubled

TWO noteworthy instances of increasing the use of energy by the application of electric heating units to linotype pots were cited at a recent convention of the New England Division of the N. E. L. A. by H. E. Duren, manager Greenfield (Mass.) Electric Light & Power Company, and E. D. Learned, power engineer Worcester Electric Light Company. At Greenfield there is a printing establishment which has for some time made a specialty of catalogs. The installation is equipped with fourteen motors with a combined capacity of 49 hp. Seven linotype machines are operated. About nine months ago electrically heated lead pots were installed.

The energy used in the heating elements is combined with the power consumption. For the nine months previous to the installation of the electric heating elements the total energy consumption was 19,090 kw.-hr. and the total bill $797.60, or an average of $88.52 per month. The first nine months' service of the electrically heated pots resulted in a total energy consumption of 39,320 kw.-hr., with a total bill of $1,411.08 and an average monthly bill of $156.78. The total connected heating load is 14.2 kw., and the revenue per kilowatt of heating apparatus per annum on the above basis is $57.60. The room is free from excessive heat and gas fumes and the temperature control far superior to the gas-heated method.

At Worcester a plant has in service thirty linotype machines with a connected load of 1,500 watts each and three monotype machines of 2,800 watts each. The energy consumption for 1922 of this installation was 165,000 kw.-hr., with a demand of 50 kw., and the average use of the demand was 275 hours per month compared with an average use of the motor demand of 160 hours per month. The power factor is between 95 and 100 per cent. Mr. Learned stated that it would be impossible satisfactorily to operate the plant with gas-heated pots on account of the discomfort caused employees. The gas-heated pot requires about one hour to attain operating temperature against thirty minutes with electric heating. The yearly revenue from the electric pot heating in this installation to the central station is about $80 per kw., compared with $25 to $30 per kilowatt of connected motor load on the same premises.

Central Station Co-operates in Developing New Residential Section


SHADOW LAWN
MODERN HOMES LARGE LOTS ADEQUATE RESTRICTIONS PRICES REASONABLE TERMS
BERRY COLLINS & CO. 63 N. BROAD ST. WAL 2200 EXCLUSIVE AGENTS
EACH HOME EQUIPPED WITH AN ELECTRIC RANGE INSTALLED BY
GEORGIA RAILWAY-POWER CO.

THE accompanying illustration shows how it is possible for the central-station company and real-estate firms to join interests in the development of residential districts. To enlist the co-operation of the real-estate brokers one of the Georgia Railway & Power Company's salesmen approached the manager of a realty company with the argument that the installation of electric ranges would increase the value of the property and mean quicker sales. As a result of several conferences twenty-two electric ranges were sold for the houses already completed and others under construction. The billboard was erected on the site of the subdivision at the expense of the central station. Real-estate agents have since reported that these houses have proved to be the best sellers.

What Other Companies Are Doing

Providence, R. I.—Electricity supplied by the Narragansett Electric Lighting Company is playing a vital part in the construction of the new Scituate dam in connection with the Providence water supply. This is to be one of the largest earth dams in the country. Energy is used for lighting and power service, including a 315-hp. centrifugal pumping installation in five units, a 75-hp. camp pumping service, a 50-hp. sawmill and a 75-hp. machine and repair shop, with lighting of eighty-six buildings used by the construction force.

Georgia.—Its water-power develvelopments in the north Georgia mountains are proving a prolific source of advertisement for the Georgia Railway & Power Company, as evidenced by the fact that during the month of August 1,032 visitors registered at the Tallulah plant and made the descent on the company's inclined railway to inspect the operations of the station at the bottom of the gorge. Fifteen states, from California to Virginia, as well as the Philippines, were represented in the visitors.

Lake Geneva, Wis.—With a view to giving the public a bird's-eye view of its electric light and power distribution system, a large relief map of the territory served by the Southern Wisconsin Electric Company was displayed at the Walworth County fair. The generating plants, transmission lines, substations, etc., of the company were built in, and each town was lighted, showing the number of lighting and heating customers served by the company.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Paper Company Completes Power Plant on the Hudson.—By the completion of the International Paper Company's Sherman Island hydro-electric development on the Hudson River near Glens Falls, N. Y., 40,000 hp. has been added to the available supply in northern New York. This plant uses the total head between the tailwater elevation of the power plant at Spier Falls and the pond of the Champlain Canal feeder dam at Glens Falls, an average of 65 ft. The ultimate installation will be five units of 10,000 hp. each and will utilize at full load a total flow of 7,600 sec.-ft.; but on account of the present unregulated flow of the Hudson River, only four units have been installed. Energy is generated at 6,600 volts and transmitted at 114,000 volts to the trunk distribution system of the Adirondack Power & Light Corporation. This seven-page article deals principally with constructional features of both the power house and dam.—*Engineering News-Record*, Sept. 20, 1923.

Boiler-Feed Water Circuits in Power Stations.—A consideration of feed-water circuits with special reference to problems of de-aëration of boiler feed. The characteristic properties as regards corrosion of water with and without air in solution are discussed. It is very important in power-station operation to determine the corrosive action of water passing to the boiler. A corrosion detector for detecting air in boiler-feed water is described.—*Electrical Times* (*England*), Sept. 13, 1923.

Generation, Control, Switching and Protection

Grounding Problems.—M. SCHIESSER.—Authorized by the Swiss Federal Electrical Commission, the author presents in this paper his findings as the result of investigations made on the different problems of safe grounding methods for central-station practice. How to provide permanent ground connections and to ground metallic or reinforced concrete transmission towers so as to minimize danger to passers-by in case of an accidental ground on the line is told as the main purpose of this article. Starting with a tabulation taken from official Swiss statistics of forty-eight electrical accidents caused by faulty groundings, the author gives an exact analysis of each case and recommends a remedy. About twenty voltage distribution charts which measure the drop of potential from the grounding point radially in all directions are reproduced for different arrangements and various soil conditions. The advantages and disadvantages of separate and combined grounding electrodes for protective and for permanent grounding are discussed. Results of tests made with pipe, plate and ribbon ground electrodes under various conditions are described and shown in photographs. It is stated that the ribbon electrode, placed singly or in several concentric rings around the station, tower, etc., and placed at a carefully determined depth, gave best results and a minimum of danger. A suggestion is accordingly made that three concentric ribbon circles, 5, 7 and 9 m. in diameter, be placed around the cement footing of a steel tower and buried respectively 5, 20 and 50 cm. deep in the ground, all being connected to the tower. With an assumed ground current of about 400 amp. this arrangement guarantees a voltage gradient not exceeding 100 volts for a distance of a man's step or arm reach.—*Bulletin de l'Association Suisse des Electriciens*, July and August, 1923.

Transmission, Substations and Distribution

Solution of Electric Power Transmission Problems by Miniature Circuits.—O. R. SCHURIG.—The author outlines the established processes by which transmission circuits in operation or to be constructed may be reproduced on a small scale in the laboratory. In this way theoretically calculated phenomena may be confirmed experimentally in a simple manner. Moreover, miniature systems afford a number of practical advantages in the experimental solution of specific circuit problems.—*General Electric Review*, September, 1923.

Large-Capacity Transformers.—G. STERN.—While the fact is not mentioned in this paper, it is apparent from its many illustrations that the magnetic circuit of transformers made by German manufacturers is built up with butt joints, a method practically unknown in America. Core-type transformers with circular coils have been standardized by the A. E. G. Previously the laminations of cores and yokes of large dimensions have been held together by a large number of rivets arranged in several rows. The possibility of a short circuit between two faulty iron bolts was considerable, and many transformers failed for this reason. Modern cores and yokes have only one row of bolts, which distribute their pressure over the entire surface of the core by means of a number of square cast-steel plates. The bolts themselves are insulated with a heavy tube of paper. Cores have a cross-section closely approaching a circle. On very large three-phase transformers, where shipment of the completely assembled apparatus is essential, a five-legged core construction is used merely for the purpose of cutting down the height of the yokes. In this construction the height of the yokes can be reduced almost 50 per cent. Transformers for a potential of more than 30,000 volts are built as a rule with two low-voltage barrel windings inclosing the inner high-voltage winding. The finished windings are vacuum-treated and lacquered to make them impervious to humidity during the assembling period. The high-voltage winding consists of single-layer disk coils, wound with paper-and-cotton-covered copper conductors of rectangular shape. Cylinders of a fibrous material called "geax" furnish the major insulation between high-voltage and low-voltage coils. The individual disk coils are separated from one another by an unusual spacing method which relieves the coils of any mechanical pressure. This coil-stacking method is claimed to be electrically excellent and to withstand without trouble mechanical shocks such as may occur during long-distance shipment or short circuits. For very high voltages a metallic static shielding ring is placed on the top and the bottom of the high-voltage coil stack and is metallically connected to the beginning and the the end of the winding. Star-delta is the usual connection of three-phase units. The delta of the low-voltage winding avoids the third harmonic, and the star permits the connection of a Petersen coil to the Y-point. Mechanical tap-changing devices are being used. Large transformers are cooled almost exclusively by external or forced oil-cooling methods, an arrangement which permits the smallest possible over-all dimensions of the machine.—*Festschrift of Elektrotechnische Zeitschrift*, Aug. 26, 1923.

Illumination

Status of Illuminating Engineering in Russia.—The last All-Russian Electrotechnic Congress (October, 1921) appointed a committee on illuminating engineering under the chairmanship of Prof. M. A. de Chatelain, the Russian representative on the International Electrotechnical Commission. The committee worked out standards and rules for the testing of electric lamps with carbon as well as tungsten filament. Very explicit regulations on school illumination are also given.—*Electrichestvo* (*Russian*), No. 4, 1923.

The Year's Progress in Illumination.—This report of the I. E. S. committee on progress covers the developments, not necessarily improvements, in the whole field of illuminating engineering as reported in the scientific and technical press. The report contains nearly a hundred pages of information which will be found valuable to any one wishing to keep up with the advances in illumination as recorded during the past year.—*Transactions of the I. E. S.*, September, 1923.

Units, Measurements and Instruments

Use of Insulating Varnishes.—A. W. STRINGHAM.—The capabilities and limitations of each kind of insulation varnish should be known to every one who uses them. The author lays down the methods of testing for dryness, oil and acid resistance, dielectric strength, etc., and gives a general discussion of the main features and field of application of each kind, with suggestions on the proper treatment.—*Electrical Record*, September, 1923.

How to Check Instrument Transformer and Meter Connections.—V. H. TODD.—Checking the polarity of instrument transformers, connecting up wattmeters, polarity of polyphase circuits, installing meter wiring in conduit and the use of multi-colored cable for wattmeter connections are among the subjects discussed in this well-illustrated article.—*Power*, Sept. 11, 1923.

Motors and Control

Starting of Synchronous Motors.—A. DOSWALD.—Synchronous motors are available for practically any motor drive. The frequently maintained opinion that a synchronous motor does not start under full load does not apply to the recently developed synchronous induction motor, which permits an easy start under at least full torque and which synchronizes under full load. For economic reasons the use of a straight synchronous motor for capacities below 25 kw. is not recommended. Improvement of power factor of lines on which there are a large number of small induction motors is much more economically accomplished by the installation of one or more large rotary condensers. A description of the synchronous induction motor, including complete wiring diagrams of such a motor with the necessary auxiliary apparatus, is given.—*Brown-Boveri Mitteilungen*, September, 1923.

Developments in Mine Pumping.—EDGAR GEALY.—The author relates how mine pumping is being revolutionized by means of automatically primed, started and controlled centrifugal pumps. The development of automatic equipment, application of simple devices to complex operations, advantages and economies realized and details of equipment and operation are discussed.—*Coal Age*, Sept. 13, 1923.

Electrophysics, Electrochemistry and Batteries

Battery Repair Methods.—During the past three years the Chicago, Burlington & Quincy Railroad has completely changed its system of overhauling car-lighting batteries. A short description of the battery-repair shop, the methods of hauling storage batteries in a special freight car and the economies effected by the new system are discussed.—*Railway Age*, Sept. 1, 1923.

Magnetic Rotary Dispersion in Paramagnetic Liquids.—R. W. ROBERTS.—It is well known that the presence of iron salts in aqueous solution will cause a diminution of the magnetic rotation of the solvent. It was found by Richardson, Roberts and Smith that the same is true for cobalt salts at ultra-violet frequencies, but not for nickel salts. As the effect shown by cobalt salts might be a dispersive one, the ordinary dispersion of aqueous solutions of several cobalt salts in the visible and ultra-violet portions of the spectrum has been investigated. The results obtained show that the depression in the magnetic rotation exhibited by aqueous solutions of cobalt salts is a true paramagnetic one, superimposed on the usual positive rotation, explained by the Hall effect.—*Paper presented before the British Association at Liverpool, England*, Sept. 12-19, 1923.

Traction

Electrification of the Railroad from Narvik to Riksgränsen in Norway.—HJ. SCHREINER.—A general description of the Norwegian part of the railroad between Lulea, Sweden and Narvik, Norway, is given. The entire Swedish part (Lulea to Riksgränsen) was opened for electrical operation on July 10, 1923. The Norwegian part (from Riksgränsen to Narvik) will be ready for electrical operation next year. Power will be supplied from the power station at Porjus, Sweden. The transmission line will carry single-phase current at 80,000 volts and 15 cycles. This voltage will be reduced to 16,200 volts in two transformer stations, each having two 1,500-kva. transformers. Six locomotives have been ordered of the type 1—C+C—1. Each locomotive has a weight of 134 metric tons. The motors are of the twin type with two pairs on each locomotive giving a total hour rating of 2,800 hp. The maximum speed will be 36 miles per hour and the maximum tractive effort 68,000 lb. The entire electrification will, when completed, have a length of about 295 miles, of which 26 miles are Norwegian and 269 miles are Swedish. It represents the longest continuous electrification in Europe.—*Teknisk Ukeblad (Norwegian)*, Aug. 31, 1923.

Testing Method to Distinguish Between an Overload and a Short Circuit on a Traction System.—R. ALLIAUME.—Substation operators on railroad systems have no sure means to know whether an automatic breaker opened on account of an undue overload or a short circuit, and in reclosing the breaker a certain chance has to be taken. A system to determine the cause of the tripping has been suggested by the author and was successfully installed and tried out on one French railway line. An alternating current of 25 cycles and 120 volts is impressed upon the faulty feeder, with a hot-wire ammeter in series. The readings on this instrument are quite different for an overload and for a short circuit, because an overload, with its usually high inductive character, will offer an alternating current a much higher resistance than a short circuit. This difference in the resistance is three to four times more pronounced for an alternating current than for regular-operation direct current. A fixed-current limiting resistance is in series with the source of alternating current to prevent a too high rise of the testing current in case of a heavy short circuit on the feeder.—*Revue Générale de l'Electricité*, Sept. 1, 1923.

Telegraphy, Telephony, Radio and Signals

Calculation of Self-Inductance of Coils Wound on Square Forms.—Y. NIWA.—In a former paper (*Researches of Electrotechnical Laboratory*, No. 73, 1918) the author considered the solenoid with rectangular section and derived a formula for the calculation of the self-inductance of such a solenoid. In the present paper he discusses the range of application in which the formula can be used with allowable error. From experiments as well as calculation it is shown that the formula may be applied with accuracy for all coils where the ratio of pitch to the diameter of the wire is less than six or seven, and even for the coils with this ratio as great as twenty or thirty.—*Researches of the Electrotechnical Laboratory*, No. 126, Tokyo, Japan.

Miscellaneous

Electric Machinery of Large Capacity.—K. SÄCHS.—The author gives a general résumé of the accomplishments in the design of large generators and motors during the last ten years, with particular attention to the problems of insulation and heating. Methods are described which enable the modern designer to build generators with windings withstanding safely the dangerous glow discharges of high voltages up to about 12,000. Metallized coil ends, with the metal connected to the stator lamination, are explained, and latest coil compounding processes are mentioned. Careful and systematic measurements of internal heating of windings have shown that mica and asbestos are safe for temperatures considerably in excess of the previous assumption. Cooling and ventilating problems of turbo-generators are discussed at length. The following interesting statement is made: A single kilowatt raises the temperature of 3 cu.m. of air 17 deg. C. per minute, so that a 30,000-kw. generator with 96 per cent efficiency and an air heating of 30 deg. requires 2,050 cu.m. of air per minute, or, in other words, there has to be blown through the generator an amount of air per hour weighing about as much as the total machine. Several successful attempts have been made to cool the stator or the rotor or both with water or with oil pumped through ducts provided next to the windings. Forced air cooling, propelled by either one or two fan shields on the machine itself or by an external blower, seems quite adequate for even the largest units where space is not limited. The author shows great familiarity with American practice and mentions frequently apparatus of our manufacture.—*Elektrotechnik und Maschinenbau*, Sept. 2, 1923.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

Conducted by PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N. Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Converter, Electrolytic

A high-tension converter with electrolytic cells has been developed for converting alternating current into direct current, or for transforming a direct current into one of higher voltage. The range is from 200 milliamp. at 600 volts direct current to 5 milliamp. at 150,000 volts direct current.—*G. Gmür, Aarau, Switzerland.*

Hydraulic Turbine, Labyrinth Seal for Reducing Leakage of

The labyrinth seal consists of a series of alternately expanded and contracted passages which destroy the velocity head and reduce the head on the final free jet to one-third of its initial value.—*H. G. Acres, Hydro-Electric Power Commission, Toronto.*

Instruments, Measuring, Life Tests on

With increasing quantity production of common measuring instruments, such as pressure gages, thermometers, ammeters, voltmeters and watt-hour meters, coupled with extensive use of such devices in connection with millions of automobiles, household utensils and the like in everyday use, the matter of studying the life of such instruments and other more specialized sorts, becomes one of first importance. A report embodying the general principles of such life tests has been recently presented to the American Societies of Mechanical Engineers by F. J. Schlink.

Insulating Material Named "Paramold"

This material has pure rubber as a base and is formed in steel dies under enormous pressure. It is suitable for transformer bushings, entrance bushings, insulating tubes, bus supports, etc. It is non-hygroscopic and retains its insulating characteristics after being subjected to boiling oil or boiling water. A power arc will cause it to burn only as long as the arc is sustained. Removing the carbonized surface restores the insulating properties of paramold. The material is resilient and withstands shocks better than porcelain. Metal parts or reinforcements can be introduced during the process of manufacture.—*Hopewell (Va.) Insulation & Manufacturing Co.*

Lamp, Daylight, for Scientific Work

The light from a "Mazda" bulb is filtered through an accurate blue-glass lens the color composition of which has been scientifically determined. The resultant north skylight rays are directed upon a reflector which increases the light diffusion and thus produces a more accurate and uniform illumination.—*Glenn Cullen, University of Pennsylvania, Philadelphia.*

Motor Starter, Overload Protection for

This overload device consists of two expansion wires stretched tight. In case of a three-wire system these expansion wires are connected in series in two of the lines, thus giving protection to all three phases. In case of two-phase circuit one expansion wire is connected in each phase. The expansion wires are sufficient to carry the normal motor current without expanding enough to trip the contact which breaks the circuit of the main holding coil. In case of a heavy overload in any circuit its expansion wire expands rapidly, and by tripping a contact that opens the holding coil of the handle, the compensator is thrown to the off position.—*Electric Controller & Manufacturing Company, Cleveland.*

Plating of Iron on Iron

The plating of iron on iron so as to produce a homogeneous, or at least an adherent and mechanically good, coating has been recently accomplished. Extremely severe service tests proved that not only was the coating produced satisfactory for press fits, but that worn shafts and undersized parts requiring severe service could be satisfactorily recovered. We have recovered armature shafts corroded by sea water, worn automobile shackle bolts, worn railway motor shafts and worn crank pins on gasoline engines.—*C. E. Skinner, Westinghouse Electric & Manufacturing Company, Pittsburgh.*

Potentiometer, Double-Range

A double-range potentiometer has been developed, with ranges of 1.6 and 0.15 volt or 0 to 200 and 0 to 20 millivolts. In these instruments the current can be checked while operating on either range, and the effect of the variable resistance of plug contact has been completely eliminated. For details see Optical Society of America, *Journal*, 1923, Vol. 7, page 665.—*Leo Behr, Cornell University, Ithaca, N. Y.*

Relays, Undervoltage

New undervoltage relays have been developed which provide protection of apparatus from damage caused by sudden return of supply voltage after its failure or reduction. These relays are used for tripping electrically operated circuit breakers when the voltage has decreased to a certain predetermined value, for automatically disconnecting motors on undervoltage, and in any case where it is desirable to operate an auxiliary circuit on the occurrence of a decrease in voltage.—*General Electric Company, Schenectady, N. Y.*

In Progress or Purposed

Alloys, Shrinkage of

The contraction and shrinkage of alloys in casting is of great practical importance. Work has just been finished on light aluminum alloys, and an investigation is under way on the contraction of a series of commercial brasses and bronzes.—*R. J. Anderson, Bureau of Mines, Washington, D. C.*

Oil, Insulating, Microscopic Study of

The dielectric strength of transformer oil is reduced by moisture, lint fibers and other impurities. A small spark gap may be so arranged that while the oil under test is being subjected to an electrostatic field it is also being observed through a microscope. In this manner the bridging over of the gap by various impurities can be directly observed. This method should be useful in a study of different oils and of different methods of filtration. For example, a filter may be very effective in removing moisture but not lint, or *vice versa*. A beginning of such a study of oil has been recently made by F. Schroeter.—*Archiv für Elektrotechnik*, 1923, Vol. 12, page 67.

Petersen Earthing Coil

The Petersen coil has decidedly reduced the number of interruptions due to insulator flashovers during lightning storms. It has, however, produced several actions which need further investigation, namely, the bus insulator flashovers which occurred when line switching was done with the coil in service. It is proposed to make further tests to see if high voltages are actually produced. Points which operating experience with the Petersen coil has thus far proved are: (1) All insulator pins should be grounded in order to secure the best action on the coil. (2) All switching, both hand and automatic, should be done with the coil out of service, and with the system neutral solidly grounded. (3) Grounded phase operation is not advisable.—*J. M. Oliver and W. W. Eberhardt, in the A. I. E. E. Journal, 1923, Vol. 42, page 904.*

Refrigerators for Household Use

In addition to the general public, the government departments and the American Engineering Standards Committee are interested in the question of specifications for household refrigerators. The bureau considered that data obtained by it several months ago on refrigerators of this type might prove sufficient to serve as a basis for a performance specification. Such a specification has been drafted after reviewing the test data and after completing numerous computations relative to heat flow in assumed cases. It is hoped that satisfactory specifications covering household refrigerators may result from this preliminary work.—*Bureau of Standards, Washington, D. C.*

Zinc, Electrothermic Metallurgy of

Because of the imperfections of the retort and electrolytic processes and of the promise which the electric furnace offers in overcoming these imperfections, the United States Bureau of Mines, in co-operation with the Missouri School of Mines and Metallurgy, has undertaken a study of the electrothermic metallurgy of zinc.

Suggestions for Research

Dielectric Tests, Use of Anilin Oil to Prevent Corona

When testing thin sheets of solid insulation for dielectric strength, it is difficult to avoid corona formation at the edges of the electrode disks. As a result a breakdown often takes place in a non-uniform field and inconsistent results are obtained. Grünewald has recently used anilin oil with good success for filling around the electrode edges to exclude the air (*Archiv für Elektrotechnik*, 1923, Vol. 12, page 81). The relative permittivity of this oil being quite high (about seven times that of the air) practically a uniform field is obtained in the sample under test, and the puncture usually takes place between the flat portions of the electrode surfaces. It would be of interest to the industry to standardize the use of some such "filler" or "stress reliever."

Frequency Converter, Cascade Type

In the development of superpower and interconnected systems frequency transformation will be involved in at least some important cases. For example, 25 cycles is used at Niagara Falls, 40 cycles in the vicinity of Albany and Troy and 60 cycles elsewhere in New York State. Some engineers look with favor upon the so-called cascade converter in place of the usual synchronous frequency changer. To tie a 25-cycle and a 60-cycle system, such a converter might consist of a ten-pole 25-cycle, 300-r.p.m. synchronous machine coupled to a fourteen-pole 60-cycle induction machine. The stator of the synchronous machine is connected through a transformer to the collector rings of the rotor of the induction machine. The 25-cycle rotating mmf. in the rotor, revolved at the frequency of 35 cycles, acts on the stator of the induction machine at the frequency of 60 cycles. In view of a possible discussion of the merits of the two types of frequency changers, an investigation is desired in which will be determined their relative weight, cost, voltage regulation, behavior under abnormal conditions and other operating characteristics.

Network, Surge-Absorbing

In the familiar Campos system of surge protection reactors are shunted by energy-absorbing resistors. A more general and more effective system of surge absorption is desired, to consist of a combination of resistances, reactances, etc., cross-connected between the phases. This network must be such (a) to absorb a negligible amount of power under balanced three-phase conditions at normal voltage, (b) instantly to begin absorbing considerable power under surge conditions, i. e., unbalanced, steep-wave-front overvoltage, (c) automatically to return to its normal functioning without moving parts. The network is thus to be of the nature of a filter, such as those which are used in the field of communication engineering.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Electricity on the Farm

Three Cabinet Members Promise Co-operation with the Committee Recently Set Up

FEDERAL co-operation in the movement to make more electric power available for use on farms was assured on Wednesday of this week, when the Secretaries of Commerce and the Interior and the Assistant Secretary of Agriculture met with the recently established Committee on the Relation of Electricity to Agriculture.

Secretary Hoover, in addressing the gathering, declared that he has long been convinced that highly profitable use of electricity could be made in connection with farming operations. He commended the industry for its willingness to co-operate to that end. In addition, he declared that the extension of electric transmission lines to the farm carried with it a new responsibility for bringing about the standardization necessary to enable farmers to obtain repair parts easily and to make convenient use of any accessory. He also pointed out the relationship of superpower projects to the movement for electricity on the farms.

Foreign Survey to Be Made

Secretary Hoover will undertake a survey at once of the use to which electric power has been put on farms in other countries. He expressed the opinion, however, that the survey will reveal that the United States already has made more progress in that direction than has any other country. He referred specifically to the use of electricity on many farms in California.

Secretary Work of the Interior Department emphasized the need for making living conditions on the farm more attractive. In addition to the government's interest on account of the general welfare, it has concern in the matter on behalf of its own establishment. He referred to the crying need at this time for making reclamation projects more attractive to farmers.

Assistant Secretary of Agriculture Gore, speaking in the unavoidable absence of Secretary Wallace, said that in these days of labor shortages on farms consideration may well be given to this project.

J. W. Coverdale, secretary of the American Farm Bureau Federation, told the committee that farmers prefer to have experiments in electrical farm equipment performed by the government or on a limited, designated scale rather than at their individual expense as was done in the pioneer days of tractor farming. Combining the activities of the Departments of Agriculture, Commerce and Interior with that of the committee, the farmers hope to introduce electric power on the farm with a smaller shrinkage in farmers' pocketbooks than occurred during the period when heavy-weight tractors were purchased by farmers long before they were so constructed as to operate economically.

Oscar E. Bradfute, president of the federation, spoke to similar effect.

Rural Service in Minnesota

At a recent meeting of farmers, representing the Minnesota Farm Bureau Association, and officials of the Northern States Power Company a plan for rural electrification that is expected to have a far-reaching influence on farming in the North Central States as well as to develop a large potential market for the output of electrical energy was drawn up. The plan provides for an experiment that will establish definitely the practicability of group or community power service in rural districts and the lowest cost at which it may be sold by the company. The scheme involves the installation of a 5-mile line through a farm community near West Concord, Minn.; providing fifteen farms with electrical equipment, tapping power from the trial line; keeping an exact record of costs of line, operation and upkeep, and computing the output of each farm before and after electrification.

Two propositions were presented at the conference. One was for the company to finance the line, the other for the farmers to buy the equipment and turn the operation over to the company. The first would require no investment on the part of the farmer, but would entail higher prices for service because of interest rates. The second would call for an investment from each customer at a cost below the price of electric systems now on the market.

Philadelphia Electric to Build Huge Plant

The Philadelphia Electric Company has just announced the purchase of 58 acres on the west shore of the Delaware River and just below the Delaware River bridge of the Pennsylvania Railroad, on which it plans to erect a large base-load power station. The plans so far are only tentative, but they contemplate a station with an ultimate rating of 600,000 kw., built in three units of 200,000 kw. each, each of them having four 50,000-kw. generating sets. This plant is an outcome of the move which the Philadelphia Electric Company is making to install capacity to meet the ever-increasing demand of the community for additional electric service.

The site of the plant is particularly favorable as there is more than 2,000 ft. frontage on the Delaware River, with its unlimited water supply, and the Pennsylvania Railroad is on the north and the Reading Railroad on the south, giving excellent rail facilities. It is expected that construction work will be started on the new power station early in 1924.

"Romex" Not Approved

But Modified Indorsement Is Given to Underfloor Duct System by Electrical Committee

ACCORDING to an announcement authorized by Dana Pierce, chairman of the electrical committee, National Fire Protection Association, "Romex" has not been approved by the committee on new developments for trial installations, and the underfloor duct system, while approved if armored cables are used, is not recommended for use with rubber-covered wires.

The formal statement authorized for publication is as follows:

"The committee on new developments of the electrical committee, National Fire Protection Association, held a meeting in New York on Oct. 15 to consider the applications for recommendations permitting trial installations of the new wiring conductor, "Romex," manufactured by the Rome Wire Company, Rome, N. Y., and of the underfloor-duct system manufactured by the Johns-Manville Company of New York City.

"The following committee opinions were adopted after full discussion:

"*'Romex'*.—The committee on new developments finds that the material 'Romex,' submitted by the Rome Wire Company, conflicts with numerous provisions of the National Electrical Code requiring protection of conductors and their separation from each other and the surfaces wired over, and further does not find properties in this material or methods of installation proposed for it which, in its opinion, warrant the committee in recommending trial installations.

"Underfloor Duct System.—The committee does not recommend trial installations of the underfloor duct system using unarmored rubber-covered wires

in the ducts. It is the opinion of the committee that when these duct systems are used with approved armored cables for the electric light and power wires the installation can be made in conformity with present requirements of the National Electrical Code, and that when the ducts are so used signal or communication wires may be run in the same ducts with the armored cable."

Motor to Help Power-Factor Trouble

A Type of Induction Motor with a Secondary Stator and a Primary Rotary-Converter-Type Rotor, Giving Leading Power Factor, Described Before N. E. L. A. Committee

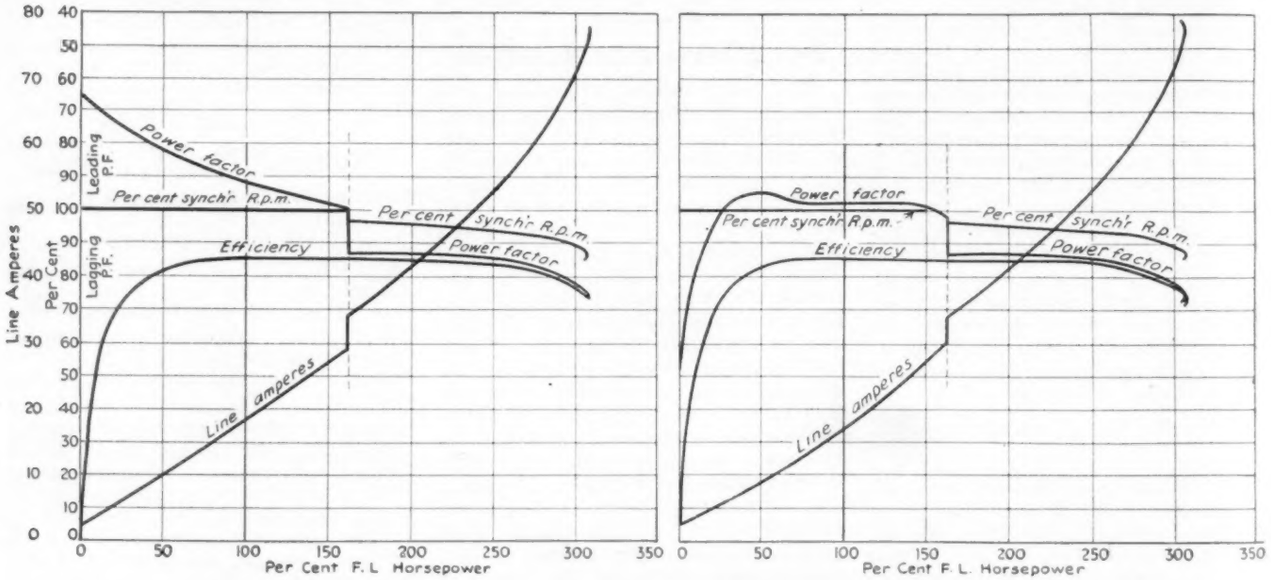
AT THE recent group committee meetings of the Technical Section of the N. E. L. A. at Omaha A. H. Timmerman of the Wagner Electric Corporation described a new motor possessing features of interest to electrical engineers generally, central-station power engineers and industrial users. It is claimed that the motor offers a unique and practicable solution to some of the power-factor difficulties on many systems in industrial communities. Extended and somewhat exaggerated news reports of this announcement appeared in many daily newspapers all over the country, some of which, as might be expected, so misinterpreted and therefore wrongly headlined the news, indicating 30 to 50 per cent increase in efficiency of motors, as to carry the impression to the informed engineer that the new development must be a fake. Others, however, grasped the correct interpretation that any motor which would draw a leading power factor and thereby utilize "idle current" would allow more effective utilization of investment.

MOTOR BASED ON FYNN PATENT

The motor is based on a patent issued to Val A. Fynn about ten years ago. It is apparently somewhat similar to the Schrage motor developed in Germany and in some characteristics apparently similar to the Danielson motor in a portion of its range of operation. The ELECTRICAL WORLD requested from Mr. Timmerman and Mr. Fynn information on the engineering details of the motor, and while these gentlemen are at the present time unwilling to present a schematic diagram of the windings and their interconnections, a statement of the general equation of the motor or of the constants of the motor, the following information furnished by them will doubtless be of interest to engineers: The motor is a combination of a synchronous and an induction motor with a rotary converter. The machine as now built carries a primary winding on the rotor connected to the line by means of slip rings and also connected to a small commutator. The stator is provided with starting and operating windings, the latter being connected to the commutator. The commutator voltage is low. The machine starts like a polyphase induction motor of usual design. Before the induction motor torque reaches zero, an additional torque is developed exceeding the full load torque, and this readily brings the motor into synchronism. The machine is held in synchronism by a suitable direct exciting current generated in the machine itself and until such time as the synchronous motor torque of the machine becomes overloaded. As the synchronous motor "breaks down" the induction-motor action automatically steps into the breach and the machine continues to operate as an induction motor. This transition is smooth and not readily detected by the casual observer except by means of some sort of stroboscope. When the overload disappears, the motor again steps back into synchronous operation. By different settings of the brushes the power factor can be adjusted to suit widely varying conditions.

The accompanying diagrams (Figs. 1, 2, and 3) indicate the characteristics of the motor, according to tests which have been made. Fig. 1 shows normal operation of the motor with brushes set for a high value of leading current at low load. Fig. 2 shows the motor adjusted close to unity power factor for most of its run. Fig 3 indicates the difference in total operation between two induction motors running in parallel and one induction motor and the new motor in parallel.

It is suggested that this motor lends itself to installation as a power-factor corrective without having to displace existing motor drives. It is proposed to build the motor in all commercial speeds and ratings at least up to 50 hp



FIGS. 1 AND 2—PERFORMANCE CURVES OF 15-HP., FOUR-POLE, 60-CYCLE, THREE-PHASE, 440-VOLT FYNN-WEICHSEL MOTOR
The curves in the right-hand diagram show the motor adjusted for approximate unity power factor, synchronous operation.

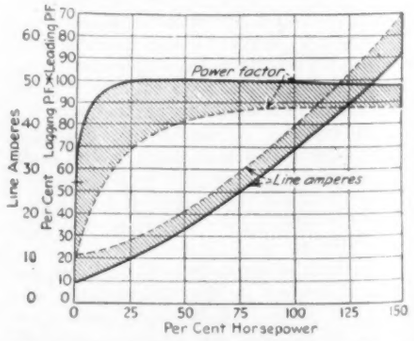


FIG. 3—15-HP., FOUR-POLE, 60-CYCLE FYNN-WEICHSEL MOTOR OPERATED IN PARALLEL WITH 15-HP., FOUR-POLE, 60-CYCLE SLIP-RING MOTOR
Solid line indicates Fynn-Weichsel motor in parallel with slip-ring motor; dotted line indicates two slip-ring induction motors in parallel.

Work for Superpower Starts

Representatives of Public Service Commissions of Ten Northeastern States Indorse Secretary Hoover's Plea for Action on North Atlantic Coast Interconnection

INDORSEMENT from public service commissioners of the ten states most interested was obtained by Secretary Hoover at last Saturday's conference in New York for his program of co-operative effort to further electrical interconnection and superpower development in the North Atlantic Coast States. Secretary Hoover read a statement he had prepared in which he emphasized the various factors which made it not only advisable but necessary for the most effective and economical development of electric service to industry and to the public in general, and thereby also to the most effective and economical development of industry itself, that state lines and territorial limitations be wiped out in the interconnection of electric power supplies. He emphasized the "liquidity of power" and the fact that it cannot be stored, but that it is the demands of the instant, of the very second, which make interconnection necessary.

New Era in Electric Power

In this statement Mr. Hoover said:

"The reason and need for this discussion is simply that engineering science has brought us to the threshold of a new era in the development of electric power. This era promises great reductions in power cost and wide expansion of its use. Fundamentally, this new stage in progress is due to the perfection of high-voltage long-line transmission and more perfect mechanical development in generation of power. We can now undertake the cheaper sources of power from water sources further afield, such as the St. Lawrence, and cheaper generation from coal through larger and more favorably placed generation plants. We can secure great economies in distribution through the interconnection of load between systems, for thus we secure a reduction of the amount of reserve equipment, a better average load factor through pooling the effect of day and seasonal variations, together with wider diversification of use by increased industrial consumption. We can assure more security in the power supply from the effect of coal strikes and from transportation interruptions.

"All this means the liquidity of power over whole groups of states. At once power distribution spreads across state lines and into diverse legal jurisdictions. We are, therefore, confronted not only with problems of the co-ordination in the industries of their engineering, financial and ownership problems, but also with new legal problems in state rights and federal relations to power distribution.

"This super-development of great areas of cheaper power has been dramatized by those less familiar with the problem as the construction of great power highways traversing several states into which we should pour great streams at high voltages from giant water-power or central steam stations to be distributed to the public utilities and other large users along the lines of these great power streams. This, indeed, serves perhaps to picture what is meant by super-power development. As a matter of practical fact, however, the natural development of this situation lies first in the interconnection of power supplies between the existing great utility systems, and second, in common action for the erection of large units of production at advantageous points for the mutual supply of two or more of the present systems and in the development of such great water powers as the St. Lawrence."

Mr. Hoover then told briefly of the results of the Superpower Survey made three years ago, at the instance of the federal government, under the direction of W. S. Murray, pointing to the indicated annual saving of more than five hundred million dollars a year from a capital outlay of a billion and a quarter, as well as to the possibilities of railroad electrification involved. He continued:

"This new era of advanced projects is no theorists' or promoters' dream. It is a basic fact unanimously supported by our engineers, agreed to by the responsible men in the industry. It is true that there has been progress in the actual application of scientific advances in our national equipment, but we are far from the realization that is to-day practicable. I do not wish to be construed as stating that no progress has been made in enlarged co-ordination of power production and distribution. The electrical companies, under the regulation of the public service commissions, have already made excellent progress in the application of super-power principles in many localities. Power interconnections on the Pacific Coast reach from the southern border of California to Oregon; the States of Illinois, Indiana, Wisconsin and Michigan are associated in a network of interconnections, as are Georgia, Alabama, North and South Carolina and Tennessee. This being the case, one purpose of this conference is to consider why development in this, the greatest power zone of our country, where the greatest saving can be made, does not make progress. What measures can be devised to stimulate it? What obstacles in its realization can be removed?

"It is said that there is a lack of definite principles and of co-ordination in the policies of necessary regulation of power utilities by the different states and a lack of co-ordination and vision in our national administration of the development of nationally controlled power sources. It is also said that we should not permit the rivalry between our distribution systems and competition for territory to restrict the establishment of interconnection of load and the development of great generating units for their common use.

"Whatever the fault may be, it is the purpose of this conference to give preliminary consideration to the problems and principles that might be adopted in interstate relations, to discuss what measures can be devised to assure this needed development and what obstacles in its realization can be removed.

Power Must Flow Freely

"In the matter of public relations to power development and distribution it appears to me that one of the first principles we must realize is that the whole of this development implies the free flow of power. We have thus at once created at least a physical and economic interstate question. This great development of so much public interest cannot come about unless there is a complete liquidity in movement of power back and forth across the boundaries throughout the whole of the United States. We cannot secure centralized generation, great water-power development or interconnection of load unless there is this free flow. Without this we shall have permanently a larger cost of power and less expansion in its service. There are time-honored disputes over states' rights with regard to water, and somewhat similar questions are being raised as to power. Subject always to the sovereignty of states in taxation, etc., unless all citizens irrespective of state may have the same rights as to use of power, we shall destroy the hopes of a very great economic development.

"I am advised that it is probably true that no embargo could be constitutionally placed upon power flow across state frontiers, but unco-ordinated legislative and regulative actions by the states and the national government might amount to economic embargoes and discriminations and thus stifle development. Again, my argument that we must have free interstate flow of power implies free flow within the states and applies with the same strength to the complete necessity of state-wide regulation uninterfered with by municipal obstruction."

Declaring that the regulation of power distribution, profits and rates is "a concept fully fixed into our governmental system," Mr. Hoover said:

"In national relations to power development the public reaction against waste and exploitation of our national resources some years ago brought about a great movement for conservation, but it imported into the practice of conservation an implication of cold storage for these resources. We must adopt a new thought on conservation. Real conservation lies in use for public interest, not in prevention of use. Every water horsepower that can be used to-day which runs to waste is a burden

on man power. I am not here to advocate that the federal government abandon its policies of conservation of national resources, but I do advocate their proper use for the nation, not the deprival of the public through old fetishes, old hates and inertia."

BUCKLAND ADVOCATES STATE ACTION

After a reference to the potentialities inherent in the development of the St. Lawrence and to the natural division of the United States into several power areas, and the utterance of a tribute to the progress, ability and public spirit of the electrical industry, Mr. Hoover called on William S. Murray to give a picture of the physical gains to be made and the physical problems to be solved in the contemplated Superpower Zone and on E. G. Buckland, vice-president New York, New Haven & Hartford Railroad, who was a member of the advisory board of the Superpower Survey made in 1921, to discuss the legal phases of the matter Mr. Buckland advocated the removal of any legal inhibitions on the exchange of power over state lines through agreement among the states rather than by federal compulsion. He favored a harmonization of state laws to permit but not to direct superpower development. Once the inhibition is removed, the very economics of the situation will do the rest, he maintained. If the people could be brought to understand the instantaneous feature of energy transfer, export and import and that for every kilowatt-hour sent a kilowatt-hour can be obtained any time that they need it, he felt that much of the hesitancy to allow or to encourage interconnection between states would be dissipated.

Mr. Buckland said he believed there ought to be devised a kind of uniform legislation—similar, for example, to the uniform negotiable securities act now in force in various states—so that the states of their own volition will arrange by adopting it that superpower can be regulated, financed, produced and transmitted and thus each state will do its part in the general economic, social and industrial development of the region. If the study is pursued, he said, there will be evolved the uniform statute which the governors and the legislatures under the advice of the utilities commissions, which are the closest students of the problem, will adopt in the best interests of their own individual states. This legislation will see to it that the development of superpower is made permissive.

Mr. Buckland said that the picture would not be complete without a statement of what he had learned from the utilities themselves. He said he had found a certain hesitancy on the part of the owners of the power stations in some places to acquiesce in the general plan in the thought that their immediate investment might be jeopardized. But Mr. Buckland pointed out that the whole theory is to use or to utilize what is now in existence and to add more.

Later on, in reply to a question as to whether there was any fundamental weakness in the project, assuming that there were no inhibitory laws, Mr. Buckland said that he knew of no state in the Union in which a comity between states did not exist with reference to business between states except where certain inhibitory laws exist. That is, if no inhibitory law exists, no permissive law is necessary. The principal difficulty as between the various states, without a permissive law, he said, is with reference to capitalization and security issues, because some of the states do have distinct statutes and differences might arise which would embarrass satisfactory capitalization and corporate organization.

COMMISSIONERS PLEDGE SUPPORT

W. A. Prendergast, the chairman of the New York Public Service Commission, pledged the co-operation of that body. He was optimistic concerning the accomplishment of joint state action looking toward power development. It is, in Mr. Prendergast's opinion, only necessary to tell the people fully and accurately what is projected in order to get the thing accomplished. He cited as a case in point the Port Authority, which is a sort of treaty between New York and New Jersey through which common port facilities are being developed and the whole port of New York and New Jersey developed as one general plan.

Commissioner William T. Gunnison of New Hampshire said that state would get behind any scheme for the economical development of power. Commissioner Richard T. Higgins of Connecticut was inclined to blame the opposition to the importation of power into that state upon the attitude of certain utility companies. Connecticut, he said, was ready to co-operate. Co-operation was pledged also by Commissioner William C. Bliss of Rhode Island, who told of the interconnection between Fall River, Mass., and Rhode Island cities.

Commissioner Everett E. Stone of Massachusetts pointed out that that state is virtually operating under a superpower system at the present time and told of its connections with all the bordering states. Commissioner W. D. B. Ainey of Pennsylvania alluded to the "tremendous human side of the program," which, he felt, could be made to appeal to the public as a whole. He expressed hearty agreement with all the major matters in Secretary Hoover's proposal and told of the superpower study now being conducted by his state. Commissioner Walter A. Dutton of Vermont said interconnection was bound to come and no law could stop it. Commissioner H. V. Osborne of New Jersey said his state needed power and the program could count on its support.

Commissioner C. E. Gurney of Maine dealt with Maine's law prohibiting the export of water power, defending its action in the past as the natural outcome of a feeling that Maine had permitted other natural resources to pass into private hands and must cling to the ones left, but asserting his interest in the arguments of Secretary Hoover and others. Maine, he said, would not be a "dog in the manger." When her own needs shall have been supplied and a general plan developed she will enter in on a proper basis. Commissioner Ezra B. Whitman of Maryland said his state, already interconnected with Pennsylvania, was sure to co-operate.

THREE OUTSTANDING PROBLEMS

Secretary Hoover said that the conference had developed that there were three outstanding problems—legal problems, engineering problems and problems of feasibility. The third class arises in cases where the possibilities are manifest enough and are accepted by utilities and yet it is not possible or does not seem feasible to bring them into the necessary co-operation to get action. It was a question then of establishing co-operation between utilities. There was the question, too, of co-operation with federal authorities and state authorities, more particularly in the case of the St. Lawrence development. In getting Canadian power international relationships come in. If there is to be any benefit from St. Lawrence power, it will actually benefit all the states, Mr. Hoover said, even though most of the power might be used in one or two states. This is because of the general fluidity of power in the form of electricity, all of which militates to keep the total investment down.

M. H. Aylesworth, executive manager of the National Electric Light Association, and O. C. Merrill, executive secretary of the Federal Power Commission, also spoke in indorsement of the project, and, at the suggestion of Mr. Hoover, it was resolved to have a larger conference in from four to six weeks to which the utility companies will be asked to send representatives. Mr. Hoover will prepare a program with the aid of the commissioners.

Third Radio Exposition Held at New York

An unusual display of the latest developments of radio receiving equipment with extensive demonstrations marked the annual radio show of the American Radio Exposition Company held in New York from Oct. 6 to Oct. 13. Compared with the exhibits of last year, the sets are more compact and have fewer controls, making them much more easy to operate. Many of the leading manufacturers exhibited sets in cabinets similar to phonographs and in one case in the base of a table lamp. Loud speakers have increased in variety of design and the indoor loop antenna has gained in favor.

Among the entertaining features were radio motion pictures and loud speakers giving a play-by-play description of the championship baseball games.

Departmental Reform

To Be Pushed by F. A. E. S.—Rejoinder to Secretary Work—President Cooley Resigns

THE executive board of the Federated American Engineering Societies resolved at its meeting in Rochester, N. Y., last week to launch a nation-wide movement to bring about the adoption by Congress of that portion of the late President Harding's government reorganization program which calls for making over the Department of the Interior. Fearing that the whole plan of government reorganization will fail, the board has determined to bend its efforts toward consolidating the functions of the Interior Department in a Division of Public Works and a Division of the Public Domain. In the Division of Public Works the engineering functions of the federal government, now scattered through many departments and bureaus, would be grouped. Several years ago engineers organized the National Public Works Department Association, with committees all over the country, for the purpose of abolishing the Interior Department and erecting in its stead a Department of Public Works. Under the present scheme of the F. A. E. S., however, the name of the Interior Department would be retained, the engineering activities being co-ordinated in a separate division. This plan will be embodied in a bill to be introduced in Congress.

Constructive co-operation in reforestation between the federal government and the states was urged by the executive board in a comprehensive resolution.

A report signed by J. Parke Channey, chairman of the federation's committee on public affairs, was read which recommended that a letter be sent to the Secretary of the Interior with reference to the dismissal of A. P. Davis as director of the Reclamation Service and in answer to Secretary Work's letter of Aug. 14, addressed to L. W. Wallace, executive secretary of the F. A. E. S. In the letter to Secretary Work it was suggested that the points be made that an engineer and a business man are not necessarily two distinct individuals, that the Secretary is wrong in assuming that as soon as a project is finished its engineering aspect ends, and that no important technical employee of the government should be dismissed arbitrarily and without a hearing. This proposed letter from the council to Secretary Work was authorized.

REGISTRATION OF ENGINEERS

The report of the committee on registration of engineers occasioned a long debate. The model law drawn up by the committee, of which Gardner S. Williams is chairman, and submitted at the St. Paul meeting is still being circulated for suggestion and comment. The mining and the chemical engineers object to any model law, urging that even if the expressed attitude of the F. A. E. S. is against registration, the attempt to insure sanity and uniformity in states where registration is inevitable by offering a law which is least objectionable will be misunderstood, the law will become known as the F. A. E. S. law and the societies will become committed to it.

Dean P. F. Walker reported for the committee on coal storage, the work of which is still in progress. The report when it is ready, about the first of the year, will deal with how coal may be stored in consideration of its physical and chemical characteristics and with methods of storage, physical means, equipment and cost. It may be possible to state what coal can be safely stored, Professor Parr being at work upon this phase of the question. The relative cost of storage in different sections and localities and a special study of the situation in New England will be included.

Eulogizing the leadership of Dean Mortimer E. Cooley as productive of dignity, respect and public confidence, the board adopted a resolution expressing great regret that Dean Cooley is forced by ill health to relinquish the presidency of the federation. Dean Cooley's successor will be elected at the annual meeting of the council to be held in Washington on Jan. 10 and 11, 1924.

Fire Damages Lines of Southern California Edison

A forest fire sweeping through the canyons near Pasadena, Cal., has caused considerable damage and a number of interruptions on the 220,000-volt lines of the Southern California Edison Company. The first flashover due to the heat and flames occurred about noon on Saturday, Oct. 13. There were eighteen flashovers during the fire, with an average interruption of one minute, each affecting those parts of the system not served by steam plants or small hydro-electric plants.

A thirty-five-mile wind caused the flames to leap 150 ft. into the air from burning brush which in some places had grown to a height of 10 ft. About two miles of the company's right-of-way was burned over, necessitating changing 2,400 insulators damaged by the heat. It is probable that a total of four spans of 683,000-circ. mil aluminum conductor will have to be replaced in the two lines in the burned area. Twenty-four poles of the company's private telephone line were burned down and the four wires so annealed that it will be necessary for the company to replace them.

Governors' Conference to Discuss "Giant Power"

Governor Pinchot of Pennsylvania was to address the fifteenth annual three-day conference of state governors at West Baden, Ind., on Friday morning, taking as his subject "Giant Power." "Railroad Valuation and the States' Obligation" was to be discussed by Governor Blaine of Wisconsin. Thirty-two governors had registered up to Wednesday evening.

Edison Opens Exposition

New York Show Attracts Veteran Inventor—"Merely at Threshold" of Development, Says Lieb

THE sixteenth New York Electrical and Industrial Exposition opened with a flourish on Wednesday of this week. Thomas A. Edison was the guest at a luncheon given by the New York Edison Company as a preliminary to the actual opening of the show. Nearly two hundred were present at this luncheon, the largest gathering of generally representative New York electrical men ever held, according to J. W. Lieb, vice-president New York Edison Company.

In his remarks Mr. Lieb mentioned the large scrappage and obsolescence in the electrical industry and laid it to the fact that no other industry has made such progress in the same time and no other industry has such a progressive spirit. While it has had an enormous expansion, and while it now has enormous popularity in industry and with the people, "we are merely at the threshold of what is in store," Mr. Lieb said.

Arthur Williams, general commercial manager New York Edison Company and president of the exposition company, thanked Mr. Edison for his attendance and pointed to New York as the greatest concrete example of that to which Mr. Edison's early work had led. "Throughout the entire range of electrical service in this city," Mr. Williams said, "one can find no single thing known to modern engineering which has been left undone to insure the highest standards of public service with the utmost economy and lowest possible price consistent with these standards. This is true whether it relates to so-called superpower—a new name for an old method long since utilized in the electrical systems of this city and many other parts of the country—or to any other known method of efficiently generating and distributing electrical energy for public uses."

USING THE "MOVIES"

Following the luncheon to Mr. Edison, a mass meeting of electrical men of New York City was held in the Forty-eighth Street Theater to hear plans for the newly organized Electrical Board of Trade and to witness the New York Edison Company's new motion-picture film, "At Your Service."

Charles L. Eidlitz, chairman of the board of governors of the Electrical Board of Trade, announced the election of Mr. Edison as the first honorary member of the body, whose objects, he explained, are "to see to it that every one engaged in the electrical business in New York City plays the game fairly and squarely with himself, his employees, his business associates and the public."

The new motion-picture film is one of the best so far produced and traces the generation of electricity in the New York Edison plants from the coal pile to the home and office. The radio "storm signal," which gives warning

of approaching clouds, enabling boilers and plants to be got ready for emergency daytime loads, proved a dramatic feature of the film. Electricity in the home and the electric fire-fighting equipment of New York City were also interestingly shown.

After the showing of the picture, Mr. Edison formally opened the exposition, some description of which will appear in an early issue of the ELECTRICAL WORLD.

Ford Says His Offer Is Still Before Congress

In the course of an acrimonious newspaper attack on Secretary of War Weeks because of the sale by the government of the Gorgas plant at Muscle Shoals, Henry Ford said:

"My offer is still before Congress. I shall not withdraw it. There is nothing whatever for me to explain. If I get Muscle Shoals, we shall run power lines 200 miles in every direction from Muscle Shoals. We have been working and have learned how to send power long distances without losses by leakage. I say this now for the benefit of the international financiers, who, with the Alabama Power Company, have Muscle Shoals almost hopelessly in their grasp."

Engineers of the Ordnance Division of the army are said to have informed Secretary Weeks that in plant No. 2 at Muscle Shoals there is laid a foundation for a steam plant capable of generating 30,000 hp. and that this plant could be completed at a maximum cost of $1,500,000. This sum could be expended by the government out of the sum paid for the Gorgas plant, putting it again in possession of a steam plant and leaving a surplus of $2,000,000 from the sale.

Ford to Develop Water Power in North Central States

Rumors that Henry Ford plans to embark upon the generation of electricity on a large scale in the North Central States are borne out by the formal application of the Ford Hydro-Electric Company to the Wisconsin Railroad Commission for permission to construct and operate a dam and power plant in the Menominee River in Florence County. The site upon which the company has decided to erect the dam is close to the Michigan line. Blueprints included with the application show how the power developed through the dam will be distributed to points all over Michigan.

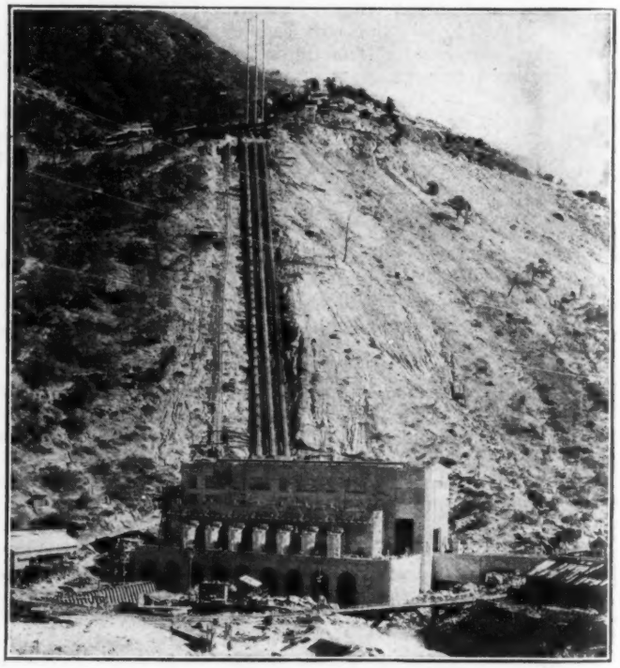
In addition to this water-power site the Ford Hydro-Electric Company controls many others along the Menominee River and on several other streams in Wisconsin. It is asserted that a great power system is to be built up by this company in Wisconsin, Minnesota and Michigan, the sites being contiguous to proposed plants where completed machines will be made or raw manufacturing operations will take place.

Largest Western Hydro Plant Starts Up

Several Noteworthy Features Have Been Embodied in the Design of Big Creek Plant No. 3—Units Have Individual Oiling Systems—Venturi Meters Are Installed

THE placing of Big Creek plant No. 3 of the Southern California Edison company on the line, as announced in the Oct. 6 issue of the ELECTRICAL WORLD, marks the completion of the fourth generating plant in the Big Creek development of this company, which will ultimately consist of about ten plants with a combined capacity of over a million horsepower. The plant has three 27,500-kva. generators operating under a head of 740 ft., making it the largest hydro-electric plant west of the Mississippi River. The addition of this plant brings the total generating capacity of the Edison system up to 501,000 hp.

There are several noteworthy features in the new plant, one of which is the omission of a separate lubricating oil system. Each bearing of the main unit has its own lubricating oil pump driven by gears from the shaft, thus eliminating outside oil filters, pumps, supply tanks and piping, which are likely to cause trouble in operation. A motor-driven pump is used to supply oil on the starting up of the unit, after which the oil supply is provided by the direct-connected pump. Stoppage of oil from the direct pump automatically starts the motor-driven pump.



BIG CREEK NO. 3 PLANT ADDS 105,000 HP. TO POWER SYSTEM OF SOUTHERN CALIFORNIA EDISON COMPANY

A feature in the design of the power house is the elimination of the basement in the generator room. As the plant is laid out, the operating floor is on two levels, one at the base of the generators and the other at the elevation of the turbines, so that virtually all of the equipment is in view of the operator at all times.

In connection with the hydraulic end of the plant there are several points of special interest. At the intake to the tunnel there is a cylindrical gate 22 ft. in diameter and 90 ft. high for shutting off the water to the tunnel line. This gate is motor-operated and is installed in a concrete tower several hundred feet upstream from the dam. A surge chamber of hour-glass section is installed at the lower end of the tunnel. It is excavated of solid rock, the bottom diameter being 60 ft., the central shaft 25 ft. and the top diameter 75 ft. The large section at the bottom provides for a load suddenly applied and the large section at the top will take care of any surge created by loads rejected.

The design of a manifold connecting an 18-ft. steel pipe from the end of the tunnel and the six 7½-ft. penstocks to operate under a head of approximately 200 ft. offered many difficulties. The design developed consists of two plate-steel spheres joined by a short section of pipe. To one of these spheres the 18-ft. pipe and two of the penstocks connect, and the other sphere provides connections for four penstocks. The entire penstock lines are of forge-welded steel. Expansion joints are installed between anchors. The expansion joints are made so that the portion of the pipe on which the packing bears is copper-plated to a thickness of about $\frac{1}{16}$ in. This will provide a perfectly smooth non-rusting surface. The pipes are installed on cast-iron rockers spaced every 40 ft. to reduce the friction. Venturi meters are installed on the three turbines in the plant to assist the operators in obtaining the maximum kilowatt-hour output from the water available.

The 220,000-volt lines from the three other plants in the Big Creek development are looped into a 220,000-volt switching station at the new No. 3 plant, where all switching for the two 275-mile, 220,000-volt lines to Los Angeles is done.

Federal Board Activities

No Agreement on Diamond Creek—Rival Projects for Susquehanna River Site

INABILITY of Secretary Wallace to attend made it impossible for the Federal Power Commission to hold the meeting scheduled for Oct. 15. Since a full attendance of the members of the commission is imperative to consider the Girand license and the other important matters which will come up at this meeting, there is some uncertainty as to the exact date on which it will be held.

No definite prediction concerning a license from the commission for the Diamond Creek (Ariz.) development can be made. The representatives of the upstream states on the Colorado River have returned to the West without having effected a compromise with James B. Girand in regard to the conditions under which a license might be issued. It has been learned that the upstream states insisted on a proviso which would make the right to use water at Diamond Creek subservient to the right to use it for power development in the upper basin. They also demanded that the license embody as conditions not only the provisions of the Colorado River compact but of any interstate pact which might be substituted for it. The financiers back of the plan decline to accept either condition. Government officials think that there was no cause for apprehension over the first condition, but there is general concurrence in the view that the second condition was unreasonable.

SUSQUEHANNA DEVELOPMENT

An important hydro-electric development near Harrisburg, Pa., is indicated by the filing with the commission of a declaration of intention by the Hydro-Electric Company, which has just been incorporated and is made up largely of engineers and other professional men living in Harrisburg. It is proposed to develop two sites on the Susquehanna River. One is at Clark's Ferry, just above the mouth of the Juniata near Harrisburg, and the other is at Millersburg, at the head of the pool it is proposed to create. A long and expensive dam will be required, but a head of 50 ft. can be developed. In addition to the sale of power, the company expects to draw material profit from a roadway across the river, which is to be built on the crest of the dam. Toll is to be collected.

The declaration of intention also covers the construction of two dams and power houses on Toms River in New Jersey. It seems probable that the Federal Power Commission will take jurisdiction over the Susquehanna development, but there is doubt as to whether or not the Toms River project will affect navigable streams.

An application for a preliminary permit covering the Clark's Ferry site has been filed by Frank M. Waring of Tyrone, Pa. His application is in direct conflict with that of the Hydro-Electric Company. Mr. Waring proposes to put in a 10-ft. dam, five-eighths of a mile long, at the head of Haldeman Island. He proposes to install 6-ft. Taintor gates to divert the stream through the minor channel to the west of the island, for a distance of 2½ miles to the power house. Under that arrangement a head of 26 ft. would be available and 30,000 hp. would be installed.

Florida's first project under the water-power act has reached the point where final action has been requested. Pursuant to its preliminary permit, the Ocklawaha River Farms, Inc., of Ocala has applied for a license to go ahead with the construction of the plant which is to make use of the dam which the federal government is to construct in the interest of improved navigation. The 700 hp. of primary power is to be used to supply the needs of the farms and small communities of the region.

NEW YORK STATE'S SUIT

There are indications that the State of New York will withdraw its suit against the government in which it threatened to test the constitutionality of the water-power act. The Department of Justice recently made informal inquiry as to whether or not the State of New York would consent to withdraw its suit without prejudice. Although the reply is understood to have indicated that the decision in the matter could not be reached until May, the belief is that the state will withdraw its suit at that time.

Hetch Hetchy Grant Held to Bar Resale of Power

A flurry has been caused in municipal government circles in San Francisco by an opinion expressed by the solicitor of the United States Department of the Interior that in selling surplus power from its Hetch Hetchy plant to the Pacific Gas & Electric Company the city has violated a provision of the Raker act, the law by which it was permitted to build a reservoir and power plant on United States land, and that its entire investment at Hetch Hetchy might conceivably be forfeited to the United States in consequence.

The advisory committee appointed by the Mayor to find a way of marketing the energy from the big new plant has made a unanimous declaration that the city, under the legal terms of the Hetch Hetchy grant, is estopped from marketing electric power for purposes of resale to any corporation or individual except a municipality or a municipal water district. It expresses itself also as unanimously opposed to the proposal that the city should market its power through a power corporation acting as the city's agent. The committee took the stand that this is merely the power-sale proposition in another form.

A recommendation to the Board of Supervisors to pass a resolution, requesting the California Railroad Commission not to consider any merger between existing private corporations distributing electricity in San Francisco, in view of the city's expressed intention to acquire one or both of those systems, was made by the committee. As already stated, neither company will consent voluntarily to the sale of its distribution plant to the city.

Americans Form Company to Develop Italian Power

The Italian Power Company, composed entirely of Americans, with a capital of $2,000,000, has been incorporated in Delaware to finance power and light properties in Italy, and a loan is now being floated in its support by a syndicate of New York bankers headed by Aldred & Company, specialists in power and light development projects. The Italian Power Company represents a new phase in the investment of American capital abroad, inasmuch as the company is neither a holding company nor an operating corporation, but will confine its activities solely to providing a vehicle for the investment of American funds in European industries. Heretofore the financing of Italy's power and light enterprises has been done chiefly with French, Swiss and German capital, which is no longer available in the amounts needed. Development of the practically unlimited water power in the Alps and Apennines is urgently needed. As stated in the ELECTRICAL WORLD for Sept. 29, Aldred & Company recently arranged a loan of $2,000,000 for the Edison Company of Milan. This the present bond issue will cover.

J. E. Aldred will be president of the new company. Its vice-president will be Howard Murray, who is also vice-president of the Shawinigan Water & Power Company, Montreal. Among the directors of the Italian Power Company are C. A. Coffin, J. W. Lieb, F. P. Royce of Stone & Webster and A. W. Burchard, president International General Electric Company.

American Committee, World Power Conference, at Work

Meeting at New York recently, the executive committee for the American committee appointed to further the World Power Conference to be held in London next year approved the plan of the committee on membership to limit invitations to take part in the conference to persons identified with engineering problems. From three hundred to five hundred such invitations will be issued, and an American representation of from seventy-five to a hundred is expected to result. Chairman O. C. Merrill named as members of a subcommittee to investigate and report upon the proposals of the British committee for the creation of a permanent organization David B. Rushmore, Calvin W. Rice, William M. Steuart, C. O. Mailloux and Gano Dunn. He urged the desirability of making the final selections for membership on the general committee and of arranging the program at the earliest practicable date.

Contractors Debate "Super-Standard" Code

Association of Electragists International Decides to Study the Possibility of Obtaining Reductions in Insurance Premiums for Work of High Quality

IN THE concluding days of the twenty-third annual convention of the Association of Electragists International at Washington last week two debates which proved exceedingly interesting formed a part of the program. On the topic "Resolved, that the best results are obtained by a combined contracting and merchandising business," M. H. Johnson, Utica, N. Y., took the affirmative and Louis Kalischer, Brooklyn, N. Y., the negative, the leaders being supported by general debate from the floor. The judges were Farquson Johnson, editor of the *Electragist;* Frank E. Watts, editor of the *Electrical Record,* and Earl E. Whitehorne, commercial editor of the ELECTRICAL WORLD. The decision was given for the affirmative, the general conclusion being that, even though profits from the sale of electrical merchandise at the present time are exceedingly small, an appliance business is, according to common experience, of great advantage to a contractor because it brings him into contact with a large number of persons and is a feeder for his contracting business.

SUPER-STANDARDS PRO AND CON

The other debate was on the question whether super-standard electrical installations would reduce the hazard of fire from electrical causes and whether a reduction in insurance rates for super-standard installations would be in the interests of the public and also tend to improve the quality of all electrical construction and build up good will for the industry. L. K. Comstock of New York led the debate for the affirmative, and F. J. T. Stewart, secretary of the New York Board of Fire Underwriters, for the negative. Mr. Comstock maintained that since a reduction in the insurance rate is given for sprinkler systems, fire doors, heavier fire walls, etc., a reduction should also be given for super-quality in electrical construction. The inspection cost, he believed, would be no greater because the inspector would need only to look for conditions as they exist and rate them according to their value for fire prevention; moreover, such a standard should have great value to the electrical industry by inducing more intelligent competition on the basis of quality. The present code, he said, is a minimum standard and tends to degrade the work to that standard. Mr. Comstock's paper appears in full in this issue, page 836.

Mr. Stewart claimed that any rate reduction possible for super-standard construction would amount to too little to justify the cost of maintaining such standards and in fact would only set up another standard which would be immediately adopted by municipalities and result in establishing a single minimum standard, though on a higher plane, through the weakening of public confidence in the present standard. The losses on electrical installations made in accordance with the present standard, he said, are so small that it would not be worth while setting up a super-standard. Such a move, he believed, would also be exceedingly embarrassing to the insurance societies because it would lead to a demand for super-standards on all other fire-prevention equipment.

Clarence Wheeler, Rochester, representing the Electrical Supply Jobbers' Association, stated that the electrical jobbers have seen with alarm the large reduction in the demand for quality materials and a great increase in the demand for low-grade materials since the cost of building has gone up. The jobbers favor the establishment of a super-standard which would enjoy a reduction in insurance rate.

W. J. Canada, representing the National Electric Light Association; Joseph Fowler of Memphis, W. J. Shore of New York, R. S. Hale of Boston, Creighton Peet of New York, Louis Kalischer of Brooklyn and Earnest McCleary of Detroit contributed to the debate. R. A. Lundquist, chief of the electrical equipment division, Department of Commerce; E. C. Crittenden, chief of the electrical division, Bureau of Standards, and F. T. Cartwright, secretary of the building code division, Bureau of Housing, acted as judges of the debate. In rendering the decision the judges agreed that a rate reduction for super-standards was desirable but that its feasibility had not been proved. On the resolution of Creighton Peet, the association approved the idea of super-standard construction, and a committee is to be appointed to investigate the matter of feasibility.

OTHER FEATURES ON PROGRAM

The following addresses concluded the program: "Illumination," Samuel G. Hibben, manager illumination bureau, Westinghouse Lamp Company; "The Electrical Press," Earl E. Whitehorne, commercial editor ELECTRICAL WORLD; "Fundamentals of Organization of Retail Electrical Business," Frank E. Watts, *Electrical Record,* New York; "The National Electrical Code," A. Penn Denton; "The Association and Its Development Work," Lawrence W. Davis, New York; "Distribution from the Manufacturers' Viewpoint," J. S. Tritle, New York; "Economies to be Effected by the Elimination of Overlapping Functions," William L. Goodwin, Society for Electrical Development.

Throughout the meeting the subject of merchandise distribution and compensation for services rendered was constantly being brought up for discussion. Finally at the suggestion of Earnest McCleary, Detroit, a committee consisting of Mr. McCleary, W. L. Goodwin, J. S. Tritle and Franz Nielson was appointed to consider the subject and make a recommendation to the meeting as to whether any definite study should be made of this problem. At the last session this committee recommended that the president appoint a special committee of three to undertake a thorough study of the subject and report to the executive committee. The following were assigned to this work: Creighton Peet, New York; Joseph Fowler, Memphis, and J. G. Crosby, Philadelphia. It was announced that the next convention of the association will be held next year on Oct. 5 at West Baden Springs, Ind.

Brief News Notes

Kent, Iowa, Sells Municipal Plant.—At a special election held at Kent, Iowa, it was voted unanimously to sell the municipal electric lighting plant to the Iowa Southern Utilities Company. The town will be served from a high-tension line.

Aberdeen, Wash., Has Municipal Project.—The city of Aberdeen, Wash., is considering the erection of a power plant on the Wynooche River at an estimated cost of $2,000,000. Engineers say that a plant capable of generating 27,000 hp. could be built on the Wynooche and that power could be furnished in Aberdeen and other Gray's Harbor cities at not more than $75 per horsepower. The Wynooche River is 20 miles from Aberdeen.

Ohio Edison Plans to Build Plant on Mad River.—Site for a proposed auxiliary power plant on the Mad River near Springfield, Ohio, has been acquired by the Ohio Edison Company, which was recently incorporated to take over several light and power projects in central western Ohio. Construction work on the new plant is expected to be started within the near future. When the plant is completed it is planned to have it and the Springfield plant of the Springfield Light, Heat & Power Company furnish all of the power for the cities and towns in which the two companies operate.

Seattle Makes Low Street-Lighting Charge for Advertising Purposes.—At a recent meeting of the Seattle City Council it was decided to cut the total amount appropriated for street lighting from $256,000 to $250,000 and to fix 1 cent per kilowatt-hour as the charge to be made by the light department for energy used in street lighting, the actual cost of maintenance of the street-lighting apparatus to be defrayed from the general fund. "Seattle can now advertise to the world that its municipal light plant is furnishing current to the city for street-lighting purposes at 1 cent a kilowatt-hour," Mayor Brown declared. "This will be a con-

vincing answer to the critics of the municipal utilities who have claimed that the light plant charges an exorbitant rate for lighting the city streets."

Pasadena Will Probably Get Pacific A. I. E. E. Convention Next Year.—A resolution was passed at the Del Monte convention of the American Institute of Electrical Engineers recommending to the board of directors of the Institute that Pasadena, Cal., be selected as the place for the Pacific Coast convention of 1924.

New Oil-Burning Plant in Kentucky.—The Kentucky Power Company is erecting a central station in Augusta to supply Augusta, Brooksville, Dover, Germantown, Minerva and probably Foster and Lenoxburg with electrical energy over transmission lines to be erected. New distribution systems will be built or old ones remodeled. The plant will be equipped with Diesel engines.

Central-Station Company to Build a Church.—When the backwater from the Chippewa Dam reservoir of the Wisconsin-Minnesota Light & Power Company flowed the lands and Indian village of Couderay it inevitably destroyed property. The Northern States Power Company, which now owns the dam, has issued a call to the Chippewa Indians for the purpose of selecting a location for a church which it will erect to replace one that was destroyed.

Only 100,000 Potential Horsepower on Hiawassee.—Regarding an item appearing in this column on Oct. 8 on the development of the Hiawassee River, Thorndike Saville of the North Carolina Geological and Economic Survey writes that it is not true that anything like 500,000 hp. can be developed on this stream and its tributaries. Although their studies are not yet complete, the engineers engaged in the survey regard it as unlikely that more than 100,000 primary horsepower can be developed.

Alabama Power Company Takes Over Tuscaloosa Utilities Company. — Arrangements have been made between the Alabama Power Company and the Tuscaloosa Railways Utilities Company whereby the first-named company will take over the operation of the lighting and power systems of the city of Tuscaloosa. It is understood that headquarters for West Alabama will be established in Tuscaloosa and that substantial reductions in rates will be a result of the new ownership.

Liebman Prize Awarded.—At a meeting last week of the Institute of Radio Engineers J. H. Morecroft presented the annual Liebman prize to Harold H. Beverage of the Radio Corporation of America. This prize is the yearly income of $10,000 presented to the Institute by anonymous members in memory of Col. Morris Liebman and is given to one of the younger men in the radio industry for some notable achievement, which in the case of Mr. Beverage was his research work on the wave antenna.

Ten Oklahoma Municipal Plants Abandoned in Eighteen Months.—The municipal electric light plant operated by Wynnewood, Okla., since 1904 has been abandoned, and its customers will be served by the Oklahoma Gas & Electric Company. This makes the tenth municipal plant abandoned in Oklahoma in the past eighteen months and taken over by the Oklahoma Gas & Electric Company.

Southern Colorado Power Company Installs New Generators.—To meet the constantly increasing demand for service, the Southern Colorado Power Company has recently completed the installation of a 10,000-hp. steam-turbine generating unit at its Pueblo plant. This gives the company a combined steam and water-power generating capacity in excess of 33,000 hp.

Superior (Wis.) Situation Before United States Supreme Court. — The question whether Superior, Wis., is entitled to take over the Superior Water, Light & Power Company for municipal ownership and operation was reached for argument in the United States Supreme Court on Wednesday, Oct. 10. Attorneys for the company contended that the city cannot take over the company for the reason that a part of the plant is in Minnesota and that a state cannot condemn a plant situated in two states, even though it furnishes its entire product in the city seeking to acquire it.

Louisiana Utility Association to Be Formed.—At a recent meeting of the Louisiana-Mississippi Public Utility Information Bureau at Baton Rouge, La., it was decided to organize a state association for Louisiana utilities along the lines of similar co-operative associations in other states. The purpose of the association will be to insure unity of action in all matters of legislation affecting the interests of the state public utilities. W. J. Aicklen, general manager of the Consumers' Light & Power Company of New Orleans, is in charge of the movement. When the association shall have been placed on an enduring footing a similar association will be formed of the public utilities of Mississippi.

Carrier-Current Adopted by Indiana Company.—Carrier-current communication has been adopted by the Central Indiana Power Company, Indianapolis, to supplement its wire lines in handling interstation communication, according to John Ferguson, manager of operation. The company has about 800 miles of transmission line which will be utilized for the guiding medium of the high-frequency carrier current. A frequency of 20,000 cycles per second has been selected. The first of these telephone sets have been installed at the power houses at Rochester and Wabash, and communication is being carried on continuously. Additional sets are being installed in all the other power houses.

Associations and Societies

Cincinnati Electric Club.—Reorganization of the Cincinnati Electric Club along the lines proposed at the conference of representatives of electrical organizations held at Association Island has just been effected. The reorganization plans, according to M. M. Curran, president, embody a newspaper advertising and publicity campaign on a large scale.

New York Electrical League Cooperates in Lectures on Artificial Lighting.—The New York Electrical League calls attention to lectures on artificial lighting to be given by F. J. McGuire of the New York City Department of Education at the Murray Hill Evening Trade School, 237 East Thirty-seventh Street, on Monday and Wednesday evenings during the ensuing weeks. Albert Goldman, 555 East Tremont Avenue, is secretary of the league.

Divisional Meeting of Oklahoma Utilities Association. — Electric light and power company operating officials and employees representing the Seventh and Ninth Districts of the Electrical Division of the Oklahoma Utilities Association met at Hobart Oct. 10 for their annual conference. W. E. Corn of Elk City, chairman of the Ninth District organization, presided. Features of the program were an address on "Public Relations," by L. P. Arnold of the Chickasha Gas & Electric Company, an address on "The Year in Regulation," by B. P. Stockwell, engineer for the Corporation Commission, and one on "High-Line Service Compared with Local Plant Service," by S. I. McElhoes.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

American Welding Society—Fort Pitt Hotel, Pittsburgh, Oct. 24-26.
West Virginia Public Utilities Association—Hotel Kanawha, Charleston, W. Va., Nov. 9-10.
Electrical Supply Jobbers' Association—Hotel Statler, Buffalo, Nov. 12-15.
Electrical Manufacturers' Club — Hot Springs, Va., Nov. 14-18.
Electrical Credit Association, Central Division—Chicago, Nov. 15-16.
Arkansas Utilities Association—Pine Bluff, Nov. 15-16.
Electric Power Club—French Lick Springs Hotel, French Lick, Ind., Nov. 19-22. S. N. Clarkson, B. F. Keith Bldg., Cleveland.
Southeastern Division, N. E. L. A.—Hillsboro Hotel, Tampa, Fla., Nov. 19-22. Charles A. Collier, Georgia Railway & Power Company, Atlanta, Ga.
American Society of Mechanical Engineers—New York City, Dec. 3-6. C. W. Rice, 29 West 39th St., New York.
National Association of Railway and Utilities Commissioners—Miami, Fla., Dec. 4-7. J. B. Walker, New York Transit Commission, New York City.
American Engineering Council (F. A. E. S.)—Washington, Jan. 10-11.
American Institute of Electrical Engineers—Midwinter convention, Philadelphia, Feb. 4-8. F. L. Hutchinson, 33 West 39th St., New York.

Commission Rulings

Reasonable Franchise Should Precede Compulsory Expansion. — Maintaining that a utility company should not be required to expend a considerable sum of money to provide additional equipment before it has received a franchise under which it can operate efficiently and economically and at the same time be protected in its investment, the Illinois Commerce Commission suggested that differences between the city of Mount Carmel and the Mount Carmel Public Utility & Service Company, which operates an electric light and power plant in that city, should be adjusted by mutual concession. "The commission has no desire," it said, "nor does it intend, to dictate the terms of the franchise ordinance. It is apparent, however, that the best interests of the city and the consumers of electrical energy in Mount Carmel will be served by the granting to the company of a franchise ordinance that is reasonable in its terms. The ordinances proposed both by the city and the company are open to criticism, and it would appear that the difference between them could be readily eliminated."

Oklahoma Commission Insists on Depreciation Reserve Funds.—A final order making compulsory on public utilities the setting up of a depreciation reserve fund has been issued by the Oklahoma Corporation Commission. It contains the following provisions: No public utility company will be permitted to pay out in dividends any sum in excess of 8 per cent on its valuation until after the full amount of allowed depreciation shall be paid into its depreciation reserve fund. This fund shall be handled separate from other funds. The depreciation reserve shall be held strictly in said fund and shall be used only for meeting depreciation or for investment in government or other high-grade listed securities paying not less than 4 per cent. The utility may borrow from its depreciation reserve fund, for a period of not to exceed three years, an amount equal to the cost of any new construction, extension or addition to the property—items chargeable to capital account—but as security to said fund there shall be deposited in same the utility's own bonds or the notes of such utility bearing interest at the rate of not less than 5 per cent per annum, which interest shall accrue to said fund. In handling such fund the utility will be held strictly accountable for its safe investment, proper administration and accounting.

Proper and Improper Charges to Operating Expenses. — Complainants against the electric rates of the Luzerne County Gas & Electric Company used the volume of business done in the twelve months ended Sept. 30, 1921, as a basis and contended that the operating expenses reported for this period should be reduced by the amounts charged for amortization of bond discount and for interest on consumers' deposits, by the use of average amounts for certain items which have varied widely in recent years and by recognition of a decline in coal prices. The Public Service Commission of Pennsylvania found that the charges for amortization of bond discount and for interest on consumers' deposits were not properly included in operating expenses. Complainants' claim of $22,500 reduction, resulting from averaging certain expenditures, was reduced to $12,-200. The quarterly statements showed a marked decline in the cost of steam generation, about 65 per cent of which is fuel cost. Complainants' claim of $48,200 reduction was based on the difference between the average cost during the year ended Sept. 30, 1921, and the cost of coal as of March 1, 1922. The evidence indicated the propriety of a reduction, the commission said, but to base this reduction on a single price level is unsatisfactory and incorrect.

Recent Court Decisions

Powers of Louisiana Commission.—The Supreme Court of Louisiana, reversing the lower court in State ex rel. Louisiana Public Service Commission vs. Lancaster, has found that the Public Service Commission has no power to inflict a penalty for violation of rules of the antecedent Railroad Commission where such violation took place prior to its own creation, notwithstanding that the Public Service Commission adopted all rules and regulations of the superseded Railroad Commission as its own. The clause in the constitution of 1921 giving the commission power to punish violations of its orders provided for the future and not for the past. (97 So. 347.)*

Maintenance of Reservoir Not a Nuisance per Se.—Jeffers vs. Montana Power Company was an action to enjoin the maintenance and operation of a reservoir at the Hebgen Dam as being a nuisance. It was contended that during the winter season when water was released for power development an unnatural fluctuation of several feet in the level of the river below resulted, which fluctuation caused the ice to break and form jams with resulting flood and damage to plaintiff's property. The Supreme Court of Montana, declaring that the impounding of water for irrigation and power development is a lawful business and not a nuisance *per se*, and that to predicate nuisance against persons or corporations acting within legislative authority negligence must be alleged and proved, which had not been done, affirmed judgment for the defendant company. The impounder of water, the court found, is not an insurer against damage caused thereby, but liable only for failure to exercise reasonable care. (217 Pac. 652.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Irrigation Corporation Held Empowered to Construct Additional Dam to Aid in Power Development.—Orme vs. Salt River Valley Water Users' Association was an action brought to enjoin the association from carrying out a contemplated improvement designated as Mormon Flat Development No. 1 and to have declared void a proposed bond issue in furtherance of it. In affirming judgment for the defendant, the Supreme Court of Arizona incidentally declared that it is within the legitimate powers of a corporation organized primarily for irrigation purposes, but authorized to construct power houses and transmission lines and to create, transmit and use power for the accomplishment of its purposes, also to install in the river, below its reservoir, a second dam, for the purpose of catching water released from above and using it again to develop power, thus enabling the association to furnish power throughout the year and secure a more advantageous market than would otherwise have been possible. (217 Pac. 935.)

Taxation of Water Rights.—Affirming in Shawmut Manufacturing Company vs. Inhabitants of Benton a judgment upholding an assessment for taxation purposes on the "privilege water right" of the plaintiff, which owns a dam across the Kennebec River together with the bed of the river on which it is erected and the land at either end on which it abuts and generates electrical energy at Fairfield, Me., the Supreme Judicial Court of Maine said: "Water power, as has been argued, in and of itself is not taxable. The reason why is that the riparian proprietor has no property in the water which runs by his land. He has, as incident to his ownership, the right of interrupting and using the water for needed and useful industries and otherwise while it passes along, and of taking thereby all the profit, utility and advantage which it may produce, without prejudice to the rights of other owners, above or below, unless he has acquired a superior right. In a word, he has the correlative rights and duties of a usufructuary. Insistence that the words 'water right' in the record of the assessment are a substitute expression for 'water power' does not find assent in the mind addressed. That which the assessors wrote is interpretable: 'We are levying, not simply a tax on a dam by a dam site, but, additionally, a tax on the site by the dam, the "privilege water right," unoccupied at the present time, but with potential possibilities, attributable to advantageous position, affecting just and assessable value, in the view of sovereignty's taxing power'." (122 At. 49.)

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

Mortimer E. Cooley Resigns Presidency of Engineering Council

Mortimer E. Cooley, dean of the College of Engineering and Architecture of the University of Michigan, has resigned as president of the American Engineering Council of the Federated American Engineering Societies, his resignation to take effect at the annual meeting in January. Dean Cooley stated that he retires on account of ill health and also made it known that he has been granted leave of absence by the university for the second half of the academic year of 1923-1924. With his retirement as principal executive of the F. A. E. S. Dean Cooley rounds out a career of almost half a century in the service of the state, of education and of his profession. He was graduated from the United States Nava. Academy in 1878, but resigned from the navy in 1885 to accept the chair of mechanical engineering at the University of Michigan, to which he had been detailed as a professor while an engineer officer in the navy. He became dean of the College of Engineering in 1904 and of the College of Architecture in 1913. His association with the university covers a period of forty years, interrupted only by service in the Spanish-American War. Since his return to the university in 1899 Mr. Cooley has been engaged in important appraisal and valuation work, including investigations for the Wisconsin Railroad Commission and the Michigan Public Utilities Commission covering public utility properties. Dean Cooley has been a prominent figure in the engineering profession's representative associations. He has served as president and vice-president of the A. S. M. E., director of the A. S. C. E., vice-president of the S. P. E. E. and president of the Michigan Engineering Society.

G. M. Pierce, manager of the Wisconsin-Minnesota Light & Power Company at Menomonie, Wis., for the past year, discontinued his business relations with this company on Oct. 10, and has formed a connection with the H. M. Byllesby & Company properties in California. His local successor has not been announced, but F. S. Schornstein, district manager of the company at Eau Claire, will direct the affairs of the company at Menomonie pending the appointment of a new manager.

J. G. Johannesen, manager of the Southern Electric Company, Baltimore, was recently elected president of the Sibley-Pitman Electric Corporation, New York City, electrical distributor. Mr. Johannesen has been prominent in the affairs of the Supply Jobbers' Association and is well known in the electrical industry. He is succeeding Theodore Beran, who resigned Oct. 8, having served as president of the Sibley corporation for six and one-half years. Mr. Beran held this post in addition to his duties as New York district manager of the General Electric Company, and he withdrew from it in order that the office might be filled by some one who could devote his whole attention to the affairs of the company.

Britton I. Budd Heads Railway Association

Britton I. Budd, president of the Public Service Company of Northern Illinois, the Chicago, North Shore & Milwaukee Railroad and the Chicago Elevated Railways, was elected president of the American Electric Railway Association at its convention held last week in Atlantic City. Mr. Budd has been associated with the transportation business since he left school, and of late years he has been nationally prominent in the electric railway field, where his record of accomplishment made his selection to direct the affairs of the association the natural one. A further recognition of Mr. Budd's achievements was made when to the Chicago, North Shore & Milwaukee Railroad, of which Mr. Budd is president, was awarded the gold medal offered this year for the first time by the Charles A. Coffin Foundation for distinguished contribution to the development of electric transportation. Details of Mr. Budd's career were recounted in the Feb. 17 issue of the ELECTRICAL WORLD at the time his election to the presidency of the Public Service Company of Northern Illinois was announced.

W. J. Cahill has relinquished his duties as system operator of the Adirondack Power & Light Corporation, Amsterdam, N. Y., to become electrical superintendent of the company's Utica district, succeeding G. E. Benkesser.

A. D. Stewart has been appointed branch manager of the Butte office of the Westinghouse Electric & Manufacturing Company, succeeding R. J. Cobban, who has been transferred to the Seattle office, where he will give special attention to mining activities.

IN VIEW of the World Power Conference to be held in London, England, next year, the *Electrical World* will publish weekly, beginning with the issue of Oct. 27, biographical sketches of prominent British electrical engineers so that Americans who contemplate attending the conference may have some acquaintance with England's representative electrical men.

N. H. McLeod is now superintendent of the Carolina Electric Company, Maxton, N. C., succeeding J. B. Moore.

W. L. Berry, sales engineer of the Union Electric Light & Power Company, St. Louis, has been appointed assistant sales manager of the company.

C. W. Campbell has been made chief engineer of the Texas Power & Light Company at Tyler, Tex., to succeed J. B. Baltimore, who resigned to take up similar work with the Cotton Belt Railroad.

W. J. Wooldridge, who recently severed his connection with the Wheeling Steel Corporation, successor to the Whitaker-Glessner Company, Portsmouth, Ohio, as was announced in the June 16 issue of the ELECTRICAL WORLD, has become manager of the electrical sheet department of the Mansfield (Ohio) Sheet & Tin Plate Company.

William H. Onken, Jr., editor of the ELECTRICAL WORLD, returned on Monday of this week from a three and one-half-month trip to Europe. While abroad he visited England, Norway, Sweden, Denmark, Germany, Austria, Switzerland, Italy and France, investigating the European situation in electrical engineering and in the electrical industry. Mr. Onken reports that this situation presents a variety of aspects of wide interest. The results of his detailed studies in the various countries will be printed in forthcoming issues of the ELECTRICAL WORLD.

Obituary

Robert B. Watts, who was associated with his brother in B. C. Watts & Company, electrical supply dealers of Denver, died suddenly on Thursday, Oct. 11. Mr. Watts was forty-five years of age.

William L. Cosgrove of Atlanta, for many years prominently identified with the Georgia Railway & Power Company as an engineer, and at one time president of the Atlanta Gas Light Company, a subsidiary organization, died Oct. 8 in a hospital at Kent, England, according to a cablegram received in Atlanta. Mr. Cosgrove, with his wife, had been traveling in Europe for the past two years, and about a month prior to his death he was striken with apoplexy. He was sixty-four years of age. He retired from active business life five years ago.

Charles E. Mann, for many years executive secretary of the Massachusetts Railroad Commission and later of the Public Service Commission and Department of Public Utilities in that state, died at Malden, Mass., Oct. 15, at the age of sixty-six. Mr. Mann was born at Natick, Mass., and for many years was engaged in newspaper work in eastern Massachusetts. In 1904 he organized the State House News Service at Boston and was also appointed secretary of the Railroad Commission. He issued valuable compilations of public utility laws in Massachusetts and in later years organized the commission library at Boston for effective service

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Super-Standard Construction Deserves a Credit on Insurance Rates*

A Frank Discussion of the Importance of Better-than-Code Construction and Its Title to Consideration by the Underwriters

By Louis K. Comstock
President L. K. Comstock & Company, New York

IT IS an unquestionable truth, though one often lost sight of, that all losses by fire must ultimately be borne by the public. The insurance companies are the machinery for distributing these losses, nothing more. If the losses fell on them, their funds, large as they are, would speedily be exhausted, and the service which they render to the public would come to an end. Therefore a necessary condition precedent to the prosperity of the insurance companies is that the rate of premium paid for insurance should be remunerative, and the main object of the tariff system is to secure such remunerative rates. Prosperity of insurance companies depends on both a decrease in fire hazards and equitable but remunerative premium rates.

The premium rate system has steadily developed in minuteness of classification and in adaptation to wider experience, as well as to changes in the character of many classes of risks by improvements in building and by the introduction of new kinds of materials and machinery. The estimates of risks and the determinations of premiums are largely governed by individual opinion and by competition, no amount of experience furnishing a statistical basis on which trustworthy predictions of average loss can be made.

Basis of Insurance Rate

Every rate is a composite of many rates evolved from experience and opinion. Every rate consists of two parts, the base rate and those other rates which affect the base rate by revision up or down. These secondary rates have been determined largely by experience, while into the base rate other considerations enter which resemble collective and competitive opinion rather than judgment resulting from the analysis of and scientific classification of data.

L. K. Comstock

That portion of the rate due to the electrical hazard falls within the group of rates forming the base rate and has not been derived from a careful scrutiny of the facts flowing from this particular hazard. While it is recognized that the electrical hazard may vary through wide ranges, depending on the varying degrees of excellence of the material used and the quality of the labor expended on them, yet no attempt has been made to vary the rate to accord with the wide differences in the hazard.

It is conceded, I hope, in the last analysis that the public pays the whole cost of insurance administration and profits, as well as all the losses and therefore is entitled to a hearing whenever it can find a mouthpiece. It is axiomatic that any plan tending toward an improvement in electrical construction from a fire hazard standpoint is desirable, and it is desirable for the following reasons.

1. It will tend toward the elimination of economic waste incident to the destruction of buildings by fire.
2. It will decrease the loss of life by fire.
3. It will tend to prevent positive losses incurred by interruptions of business, the processes of production and the pursuit of pleasure.

Workmanship Should Be Rated

It is a well-known fact that there are in nearly every line of material used in electrical construction articles possessing qualities of serviceability and durability far in excess of the quality known as "code" material. Heretofore underwriters have confined their attention almost solely to materials and have been all but silent on workmanship. But the quality of workmanship can be greatly improved and ought to be entitled to consideration in the same manner as super-standard quality of materials.

Code material represents the lowest permissible standard, and whenever higher qualities of material and workmanship find their way into installations, they do so against the competition of low-standard materials, a competition unsound economically and ruinous financially to the competitors; but insurance companies do not recognize the value of better construction by a lower rate of insurance.

Various other fire risks have and ought to have their appropriate valuation in the making of rates. As instances of this I need only mention the reduction of rates when watchmen's clocks are used; the reduction of rates for the use of fire-alarm and sprinkler systems, wire-glass, fire doors, fire walls and elevator inclosures. The fire hazard due to electrical installation, however, is not separately evaluated in rate making, but is lumped into the base rate along with other risk considerations, such as fire department equipment, frequency of stations, efficiency, district

*A paper presented before the Association of Electragists International, Washington, D. C., Oct. 12, 1923.

characteristics, competition and other points which individually do not yield readily to scientific evaluation.

Notwithstanding the fact that in the consideration of rate making underwriters regard fire risks due to electrical causes as of small import, yet it has been estimated that from 4 per cent to 5 per cent of all urban fires are of electrical origin, because of faulty material, faulty installation or the wrong use of proper materials. If any appreciable number of fires are of a determinable origin, it would seem that that particular risk ought to be separately evaluated and that the rate of insurance should be correspondingly affected. A rate ought to be lowered in direct proportion as its corresponding risk is removed, and ought to be raised in proportion to the presence of its risk.

"GIVE" DEMANDS "TAKE" ALSO

Underwriters have set the lowest permissible standard by putting their stamp of approval on so called "code" material; but on the basis of the use of code material many fires are known to have an electrical origin, and many other fires whose origin is pronounced "unknown" by the fire marshal are undoubtedly of electrical origin, owing to the use of faulty material or the wrong use of right material. Therefore, if installations are made of a super-standard quality, a reduced rate of insurance is indicated.

Should the fire underwriters admit this contention, but plead impracticability on the ground that the risk is small and an appropriate adjustment of the rate difficult, they place themselves in an untenable position, because a risk that causes 4 per cent or 5 per cent of all fires is measurable, and if measurable, the risk can be translated into an adjustment of the rate. Should the fire underwriters argue against the reduced rate on the ground of difficulty of inspection, it may be said, by way of retort, that the difficulty of inspection need be no greater, because the inspector under present conditions merely satisfies himself that code material has been used, and under the proposed conditions he would spend no more time in satisfying himself that super-standard material had been used.

Every one knows that there is much material manufactured many degrees better than code, and if such super-code material is used, it is but common sense to conclude that the installation of super-code material is a better risk from an insurance viewpoint; and if such an installation is a better risk, that fact ought to be reflected in the rate.

In New York the underwriters admit that out of a total of 2,357 orders to remedy 57 per cent were ignored. These refusals or failures to remedy were no doubt listed with the insurance companies and no doubt resulted in an increased rate. If therefore there is a penalty for failure to comply with the code, there should be a benefit in the form of a decreased rate accruing to policy holders if super-code material is used.

THE LIFE HAZARD

If the underwriters would adopt the principle of penalties for substandard work and the correlative principle of benefits for super-standard work, losses by fire would be reduced and hazard to life would decrease. The life hazard seems to have been lost sight of. A fire hazard has always a potential life hazard. Almost all insurance companies make good the fire damage—what is to be said about the life hazard? If the life insurance companies are awake to this situation, they should be interested also in better standards of electrical construction and an increase in the use of super-code material.

If, as has been stated, the fire loss due to the electrical hazard is 4 per cent or 5 per cent, how can the insurance companies afford to skimp on their inspections? That the inspections in cities like New York, Philadelphia and Chicago are insufficient is established by the fact that out of a total loss of $205,883 in 1922 in New York, the underwriters stated that $189,749 occurred on premises which had not been inspected at all and of which they had no knowledge. Perhaps some of this sort of thing will always occur, but obviously the proportion indicated here is altogether too large and requires attention on the part of insurance companies. If the underwriters cause it to be generally understood that a reduction in premium rates is available when super-standard construction is used, that fact alone will go a long way toward the elimination of fire losses from electrical causes and the consequent fear on the part of the public of the use of electricity.

I ask the very serious consideration of the underwriters to the question of the creation of a super-standard code of electrical material, with a corresponding reduction in premium rates.

I have shown the public interest in a super-code standard. That the adoption of a super-code standard will improve the quality of electrical construction is so axiomatic that it requires no debate.

The adoption of a super-code standard will build up good will in industry. This statement is also beyond the field of debate, but it requires restatement, about as follows: The adoption of a super-code standard, accompanied by a reduction in premium rate, will tend to make competition more intelligent than it is now. It would introduce into the comparison of bids an element, now lacking, tending toward a proper evaluation of both workmanship and materials; and any fact which introduces more intelligence into the comparison of bids makes for good will in the industry.

Japanese Methods of Foreign Purchase

ELECTRICAL men, appreciating the tremendous need for electrical materials and equipment of every description in the devastated area of Japan, are particularly interested in the possibilities for immediate sales to the Island Empire and desirous of knowing just how to approach the market. For the information of American manufacturers the Department of Commerce has just issued a bulletin which bears on the Japanese methods of foreign purchase in the rehabilitation of the earthquake area. Much of the essential buying abroad by the Japanese to date has been done at the foreign sources of production. The import business of Japan is being gradually taken away from the representatives of foreign exporters in Japan, however, and placed in the hands of foreign representatives of large Japanese importing houses. Thus practically all the raw cotton which Japan uses, and which constitutes nearly 30 per cent of her total imports, is purchased by Japanese agents in the raw-cotton centers of the United States and in India. Much of the wool which is used in Japan is purchased at the source in Australia, and the same is true of other raw materials for manufacture, including lumber, leather and some iron and

steel. On the other hand, in such items as machinery, fabricated-steel products and other specialties, which require an expert knowledge in their utilization—in which electrical equipment would naturally be included—the tendency has been to purchase such articles from foreign representatives in Japan and with the commodity to purchase also the services of expert mechanics and erection and construction engineers.

The outstanding items in import needs are indicated by the type of industries affected in Tokyo. The accompanying figures show paid-up capital in the various industries as of 1920, and the relative importance of these industries has remained virtually the same to date.

CAPITAL OF JAPANESE INDUSTRIES

Electrical goods	$84,566,835
Metal ware	46,847,439
Machine shops	30,202,538
Shipbuilding and vehicle manufacturing	22,742,700
Gas works	19,881,250
Weaving	15,268,092
Electrical machinery	11,291,712
Paper and paper goods	11,048,025
House building	10,680,965
Chemical manufacture	7,022,000
All other industries	284,198,642
Total	$543,790,198

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

THE spirit of caution which has characterized American business for many months has evidenced itself conspicuously in the electrical industry in the past week. According to custom, the opening of the fall buying season registered first in New England some time ago and spread rapidly across the country so that corroborating reports of increasing market activity came from all sections of the United States. Last week, however, there was a distinct lull reported from nearly all points except New England and the Southeast.

Business was active in the Boston district; apparatus sales were growing, radio demand heavier, fixture business unusually good and competition keener on wire, and there was some complaint from central stations on delayed deliveries. Atlanta reported a very satisfactory volume of business in practically all lines and active selling in industrial apparatus and heavy lines. Although appliance sales and the demand for conduit and cable were good in New York, buyers seemed to be limiting their purchases and the week was quiet otherwise. Chicago reported good demand for wire, conduit and pole-line hardware and, in fact, some demand by telegraph for conduit and cable lines, perhaps due to rumors there of a possible railroad strike. In San Francisco fixture business showed improvement and orders from operating companies and railroads were good. Bare copper wire dropped ¼ cent and the rest of the market had eased up, though schedule material was in fair demand.

In short, the lull was general but has been interpreted almost universally as an evidence of the cautious condition of purchasing and no discouragement is felt. In fact, from all quarters the utmost confidence is expressed that the fall market will be exceedingly strong and the demand for holiday goods abnormal. Indications from the manufacturing field prove a healthy condition of the industry, for record-breaking employment, an active program of construction and a heavy record of sales and profits compared with last year have formed conspicuous features of recent news from the electrical manufacturing and trade centers.

Waterwheel Market Strong with Very Keen Competition

A STEADILY increasing interest throughout the industry in the development of water power has been building up a strong market for the manufacturers of waterwheels, and the outlook is exceptionally good. The bulk of the business at the present time is coming from the Pacific Coast. The New England States stand second today in the volume of demand.

Conditions in this field have been changing during recent years. Formerly there were two well-defined types of waterwheels produced by different manufacturers, who specialized either in impulse or reactance-type wheels and had their field pretty much to themselves. Gradually, however, this rigid specialization has been breaking down and some manufacturers have been overlapping into both fields, with the result that competition is much more intense and the increased number of lines has made a healthier situation from the buyers' viewpoint. There is a question, however, as to whether this rivalry is not being carried too far and depressing prices too greatly in consideration of the value of this product.

Waterwheels run into a large amount of money, and the tendency is for this to increase as larger units are developed. Hydraulic engineers are building wheels of the maximum size that can be employed economically in line with the growth of interconnected systems. But the cost of selling is exceedingly high, for every installation involves an individual engineering problem and construction job with a very small degree of standardization possible, and because the element of maintenance and repair is very small, the manufacturer must make his profit on the initial sale.

There are four or five principal manufacturers employed in the field and rivalry is very keen. Different makes have their own patented features, but these are usually of secondary importance, so that the field is fairly open and bidding is close. The opinion is expressed, therefore, that the hydraulic waterwheel purchaser is actually getting his equipment today more cheaply than he should, and that if the very heavy service costs are to be carried by the manufacturer, the future is bound to bring a necessity for an increased price on waterwheels.

Larger Instruments for Schools; Progress of Standardization

WITH buying in the electrical instrument field at its highest peak for the year, several interesting developments affecting both engineering principles and merchandising problems have come to the surface of that business. Manufacturers are noting a distinct trend toward specialized lines. Schools, experimental agencies and laboratories are now buying instruments which have been specially ordered to suit their purposes, and those manufacturers who cater to this class of purchasers have found it possible to manufacture and sell large quantities of these special instruments at a reasonable price with fair profit. There is a demand for very large instruments with illuminated dials which may be adjusted to several kinds of reading.

Most instruments for automobiles are being made by a class of manufacturer who might be classed as semi-electrical. This is particularly true since the cheaper makes of automobiles are demanding lower costs for every part of equipment which enters into these cars. Where once the automobile manufacturer was very willing to buy instruments at a full cost of $5, simplification of parts and use of lower values in materials, together with production in large quantities, are making it possible to buy an equally satisfactory instrument at less than one dollar. The same situation is working itself out in the radio field, where some manufacturers of better grades of instruments believe they have a greater opportunity to obtain business than they have in the automotive field. However, many of the most expensive automobiles in the American field continue to use only instruments made by high-grade instrument manufacturers.

The trend in the switchboard field is away from the use of many dials to record readings at many different places on circuits and decidedly toward fewer instruments to afford easier reading and therefore avoidance of errors. In the industrial switchboard field and in the central stations as well the movement is

away from illuminated and large dials for general use.

It is believed by the instrument manufacturers that all standardization programs set by the different societies and associations have been carried out as nearly as possible. They claim that their businesses must be guided by consideration of the good service which they must give to their customers, rather than by an effort to make a product which will be interchangeable in its make-up because another manufacturer is able to fit any one of his numerous parts in it. The three-hole base on instruments is now universally used, while further progress has been made during the past three months by the standardization bodies toward developing different widths and depths.

New York's Market Sustained by Appliances and Cable

NEW YORK'S electrical jobbing and manufacturing circles report a steady market which is greatly sustained by heavy household appliance sales and attractive orders for armored cable and conduit. Among the important consumers—central stations, railroads, etc.—there is a feeling of doubt concerning the future of prices. Some wide fluctuations in the price of wire and wiring devices have, in turn, caused leading manufacturers in these lines to curb operations as to future orders. Moreover, at the present time the jobbers say that the trend toward the limiting of purchases to actual requirements shows signs of growing stronger.

Seasonal requirements for holiday goods have bettered the market generally, but the expectations of the jobbers and manufacturers have not been reached thus far, and quotations are easier in those markets which supply the needs of new construction and which so recently showed unusual strength. Several advertising campaigns for lamps, fixtures, all kinds of household appliances and wiring devices which started in the metropolitan territory in the last week are reported to be progressing well. As three of these campaigns are the largest ever seen in this territory, it is evident that trade circles feel very confident of the near future and expect great returns in this season's market.

West Coast Circles Report a Short Lull in Buying

A RATHER quiet week is reported in the West Coast's electrical markets. Authorities in that field state that this falling off in demand is not caused by any undue depression in that territory. They consider it merely as a short lull in buying. In fact, jobbers and manufacturers in that territory expect this season's business to be record-breaking for many of the commodities entering into new construction and extensions of central-station lines. Stocks of materials are still fairly high, and additional effort by advertising is being made to improve their movement before the period of inventory taking.

Bare copper wire has dropped another quarter of a cent to $19.50, base, but the insulated wires are still firm and perhaps due for an advance in the near future. Schedule material is selling briskly, with an especially good call for brass-shell sockets and the new shallow convenience outlets. Fixture sales are improving in the office lighting units. Some improvement is seen in buying by the railroad and power companies.

Chicago Jobbers Report Improved Business; Utilities Active

ELECTRICAL jobbers in Chicago report an encouraging week of trade. While no startingly large business has been booked, the volume as a whole seems to show a better outlook for the fall months. Contractors and smaller dealers are buying more heavily than they have done in the past two months. With renewed building activity business looks promising. Central-station companies have purchased considerable quantities of wire, conduit and pole-line hardware and other sales of these three items have increased. Conduit prices remain firm, but there is a rumor prevalent that the price is about to advance, several conduit manufacturers reporting that they have received numerous large orders which were telegraphed in from their jobbers. While there is no price advance indicated at this time, the sudden loading up of the conduit mills would have a tendency to bring about a price increase.

Atlanta Reports Spotty Conditions; Stocks Are Ample

EXCELLENT cotton crops in certain localities, with almost an absence of crops in others, are causing particularly spotty conditions over the Southeast, with the result that conflicting reports of business prosperity are very much in evidence. Those sections where the agricultural conditions are unfavorable are being bolstered up materially by the presence of industrial plants of large size and by construction work.

The volume of business reported by jobbers, while in keeping with the general conditions mentioned above, is on the whole very satisfactory, with stocks in practically all lines ample to meet current demands. Throughout the entire section counties are holding their annual fairs, which are being well attended, and manufacturers having farm-lighting equipment exhibits at these fairs anticipate a material increase in the volume of sales and are making preparations accordingly.

It is anticipated that the holiday trade this fall will set a record, although few actual orders have been received from the retailers as yet. The lull in industrial apparatus and other heavy lines reported for the month of September is being replaced by considerable activity, one of the largest of the jobbers having closed orders this week for two industrial-plant installations of unusual size, with prospects very bright for additional orders in the near future.

New England Business Active with Well-Distributed Orders

JOBBERS report active business with well-distributed orders and increasing demand for radio apparatus, fixtures and appliances. Stocks are readily meeting current requirements but are being refilled constantly. House wiring and lamp sales are vigorous and apartment-house construction in Greater Boston is absorbing liberal quotas of electrical material. Apparatus manufacturers report substantial gains over last year's business, and central-station outputs are taxing generating-plant facilities in most localities.

Prices weakened slightly on rubber-covered No. 14 wire this week and sockets also showed a tendency toward lower quotations. Competitive conditions apparently account for this. General business in New England continues in excellent volume, barring spotty conditions in textiles. Building contracts in New England totaled $7,551,900 for the week ended Oct. 9 against $5,487,000 for the same week last year. A fine fixture business is being handled this fall, and both sign and billboard lighting are developing rapidly in the Boston district. Central-station complaints of slow cable deliveries are being heard in some quarters.

The Metal Market

PRICES of metals have been somewhat lower during the last week. Copper has been particularly weak, despite some business at the 13-cent level. Lead and zinc prices have been rather well maintained, but the undertone is none too strong.

The Western Electric Company, according to an announcement in the financial district last week, recently has purchased between 15,000,000 lb. and 20,000,000 lb. of copper at 13 cents a pound. The fact that such a large consumer of the metal has placed orders of this size was interpreted in some quarters of the trade as indicating a resumption of buying by other users.

The official contract price of lead by the American Smelting & Refining Company continues at 6.85 cents, New York. Although quotations are nominally unchanged, a slightly weaker tendency in the New York lead market is evident. It is now possible to buy lead from Middle Western producers for delivery in the East at the same level as that asked for lead refined on the Eastern seaboard, despite the fact that this lead will in general not net sellers more than 6.50 cents at St. Louis.

NEW YORK METAL MARKET PRICES

	Oct. 10, 1923 Cents per Pound	Oct. 17, 1923 Cents per Pound
Copper, electrolytic	13.00	13.00
Lead, Am.S.& R.price	6.85	6.85
Antimony	7.75	7.75
Nickel, ingot	27.00 to 32.00	27.00 to 32.00
Zinc, spot	6.30	6.25
Tin, Straits	41.75	41.75
Aluminum, 98 to 99 per cent.	26.00 to 27.00	26.00 to 27.00

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

General Electric Orders Running 30 per Cent Above 1922

The General Electric Company received orders amounting to $65,483,549 during the three months which ended Sept. 30, as against orders totaling $58,914,620 in the corresponding three months of 1922, an increase of 11 per cent.

For the first three-quarters of the present year, covering the nine months ended Sept. 30, the orders amounted to $229,747,304, compared with $176,171,194 in the corresponding period of 1922, or a gain of 30 per cent.

Norma Company of America Places Contracts

The Norma Company of America has placed contracts for the erection of the first unit of its new plant upon its property recently acquired at Stamford, Conn. This property consists of seventeen acres of land facing the main-line tracks of the New York, New Haven & Hartford Railroad adjacent to Glenbrook station, and the buildings now under construction will be of one story sawtooth roof type occupying about 60,000 sq.ft. of space. The company's present plant at Anable Avenue, Long Island City, will be continued for the production of Norma precision open-type annular ball bearings.

The company's Stamford plant will be equipped for the manufacture of Hoffmann precision roller bearings, the American rights to which, as well as to all other Hoffmann products, were recently acquired by the company from the Hoffmann Manufacturing Company, Ltd., of Chelmsford, Essex, England. The plant will also be equipped for the expansion of the manufacture of Norma precision ball bearings.

St. Louis Mazda Making Extensive Changes in Factory Equipment

The St. Louis Mazda Lamp Division of the General Electric Company, at 6251 Etzel Avenue, is making extensive changes in its factory equipment, which when completed will make possible an increase in production from 60,000 lamps per day to 100,000 lamps per day.

These changes consist of replacing much of the old machinery used in the manufacture of incandesent lamps with the newest and most improved machinery obtainable for this purpose. In addition to the installation of this new machinery the lighting system is being completely changed. The General Electric Company's new totally inclosed lamps for factory lighting will be installed throughout the plant, increasing the intensity of illumination from about 3 foot-candles to 10 foot-candles on the working plane.

Decision in Battery Suit

A long-drawn lawsuit between rival electrical manufacturers of Madison, Wis., which has continued in the courts there for more than a year, was terminated on Sept. 25, when Judge E. Ray Stevens of the Circuit Court awarded the rights of one patent process to the Burgess Laboratories and gave the right of other battery patents to the French Battery & Carbon Company.

It is estimated that the suit has cost $100,000 to date, and the case is now expected to be taken before the Supreme Court for final decision. The Burgess Laboratories won the right to the chromate process, said to be valuable in the manufacture of dry-cell batteries for flashlights, etc. The French company was ordered by Judge Stevens to pay the Burgess company $50,000 in cash to compensate it for the use of the process since 1922.

Appoints Mrs. Jane Carroll to Promote the "Apex" Products

Appointment of Mrs. Jane Carroll to head its newly organized department of home economics was announced last week by the Apex Electrical Distributing Company, Cleveland, manufacturer of household appliances.

Mrs. Carroll is well known for the essays by her on home economics in electrical housekeeping which have been published by the daily and trade newspapers. During the last five years she has conducted sewing and cooking classes in New York City in connection with promotion work by New York central-station companies. Her first work for the Apex company will be to travel and educate various district managers on the merits of the company's latest appliance, the "Rotarex Electric Kook-Rite." Later she will conduct an electrical housekeeping school for the exemplification of better electrical methods of cleaning, washing, ironing and cooking.

Western Electric Employees Own 140,000 Shares of Stock

Western Electric employees to date have purchased and are paying for more than 140,000 shares of stock. This is about $18,000,000 worth in the Western Electric Company and the American Telephone & Telegraph Company. About 2,000, or 30 per cent of the number of employees eligible, are participating in the various purchase plans.

Goodyear & Hammersley Agents of Electric Power Equipment

The Electric Power Equipment Corporation, 412 North Eighteenth Street, Philadelphia, announces the appointment of Goodyear & Hammersley, Inc., 30 Church Street, as its agents in the New York and northern New Jersey territory.

Mr. Goodyear is an electrical engineer and has been employed by the Electric Power Equipment Corporation for a number of years. Prior to his connection with that company, he was sales engineer in charge of sales and service engineering for the Rail Welding & Bonding Company of Cleveland. Mr. Hammersley was associated with the Electric Storage Battery Company of Philadelphia.

Appropriations for Specialists in Foreign Markets

Industry is becoming convinced more and more, judging from communications reaching Washington, that commodity specialists should be employed abroad to a greater extent than is the case at present. With a very few exceptions, the government's representatives abroad who deal with industrial matters are expected to report on all commodities and all lines of endeavor in which this country is interested.

While there is no expression of feeling that the maintenance of such men is not more than justified by the value of material which they submit, the need for specialists, particularly in those countries offering promising markets for machinery, chemicals and electrical equipment, nevertheless exists. Specialized knowledge of these lines is almost essential to a comprehensive analysis of the trade possibilities.

There is reason to think that Congress will consider at the forthcoming session the granting of an appropriation for a limited experiment along those lines.

Link-Belt Acquires Business of Meese & Gottfried

Charles Piez, president of the Link-Belt Company, Chicago, announces the purchase of the Meese & Gottfried Company, San Francisco, Los Angeles, Seattle and Portland. For the past ten years the Link-Belt Company has been distributing its products on the West Coast through its subsidiaries, the Link-Belt Northwest Company at Seattle and the Link-Belt Pacific Company at San Francisco. The improvement in distributing facilities effected by the consolidation and the additional manufacturing facilities acquired should give the rapidly growing industries of the Pacific Coast highly economical and efficient service.

The Meese & Gottfried Company and its predecessors have been manufacturers of power-transmission machinery on the West Coast for more than forty years. It is the intention of the new owner to add to the facilities and en-

large present stocks so that prompt service to its customers will be insured.

The new organization will be known as the Link-Belt Meese & Gottfried Company, with headquarters at San Francisco. The officials will be: Charles Piez, chairman of the board; B. A. Gayman, president; Harold H. Clark, vice-president and sales manager; Leslie W. Shirley, treasurer, and Richard W. Yerkes, secretary.

American Smelting & Refining Wants to Market Own Copper

Permission has been asked by the American Smelting & Refining Company to sell independently of the Copper Export Association copper which it is marketing on contract for smaller producers who are not members of the association. It is said that no action has been taken as yet by the association on the request.

The smelting company is said to have expressed its desire to continue as a member of the association, but feels that its hands should not be tied in the matter of disposing of copper through contract for small companies.

Robbins & Myers Receives Large Contract from Eden Washer

The Robbins & Myers Company, Springfield, Ohio, announces that it has just booked one of the largest contracts ever received by the company, and as a result immediate increase in the working force is contemplated. The contract comes from the Eden Washer Corporation of Paterson, N. J., and covers the manufacture of 1,000 "Eden" electrical washers a month for the company. Material is already arriving and production at the local plant will begin at once.

Westinghouse Japanese Order

The Westinghouse Electric International Company has received orders for electrical apparatus to be used in reconstruction work in Japan totaling well over a million dollars. Other orders are in course of negotiation which will bring the total amount to approximately two million dollars. It is understood that the power plants in the earthquake zone were not seriously damaged, but that the distribution systems were practically destroyed.

Mathias-Hart Opens Office in Newark to Better Service

In order to take care of the rapidly growing business of the Mathias-Hart Company, Boston, manufacturer of linemen's tools and equipment, an office has been opened at 101 Halsey Street, Newark, N. J., in charge of Robert Mathias, who was one of the originators of the firm.

All business originating outside of the New England States is now being handled from the Newark office, where adequate stocks are being carried.

Lincoln Electric Company Moves Into Larger Plant

The Lincoln Electric Company, manufacturer of motors and arc-welding equipment, Cleveland, has recently completed removal from its old plant at Thirty-eighth Street and Kelley Avenue to its new location at Coit and Kirby Avenues.

In the new location the Lincoln Electric Company has nearly five acres of floor space, more than half of this space being on one floor, where the main manufacturing will be done. Adequate railroad siding facilities are also available. The larger plant provides for the materially increased production which has been found necessary to meet growing demand.

International Combustion Dividend

The International Combustion Engineering Corporation in announcing the regular quarterly dividend of 50 cents per share states that the corporation now has outstanding 374,759 shares, of which 49,952 shares were recently acquired by stockholders and the underwriters of the offering to stockholders, and 75,048 shares were issued in connection with the acquisition of all of the now outstanding stock, 2,500 shares of the Raymond Brothers Impact Pulverizer Company.

Planning "Palace of Electricity" at San Francisco Exposition

The electrical industry is planning to secure the entire right wing of the big auditorium at the third annual California Industrial Exposition, which is to be held in the San Francisco Civic Auditorium from Saturday, Nov. 17, to Sunday, Dec. 2, inclusive. This section will be named the "Palace of Electricity" and will be divided into about forty booths, each having a floor space 10 ft. wide by 10 ft. deep. One hundred and fifty dollars will be the rental of each of these spaces for the period of the exposition. Many interesting exhibits of radio and household devices are promised, with the usual impressive power displays.

This exposition is held "in the interest of exhibitors and manufacturers, for the industrial development of San Francisco, the Bay Cities and northern and central California." Working exhibits, showing products being manufactured or assembled, are desired.

Mitchell-Rand Production Not Affected by Slight Fire

The Mitchell-Rand Manufacturing Company, 18 Vesey Street, New York City, maufacturer of electrical insulating materials, wishes to correct the impression that a fire which occurred Oct. 8 at its factory in Jersey City in any way affected its production.

Accounts of the fire in the daily papers, officials of the company state, were overdrawn. The blaze was confined to the wax-compound department, where production was resumed almost immediately.

The Western Electric Company announces that it has moved its supply advertising department to 100 East Forty-second Street from 195 Broadway, New York City.

John R. Thornton, for five years manager of the Carter Electric Company's Savannah warehouse, has resigned his position with the Carter Electric Company to take a position with the Westinghouse Lamp Company where he will have charge of lamp sales in North and South Carolina. This change becomes effective Nov. 1.

W. O. Jaudon has resigned as purchasing agent of the Walker Electric & Plumbing Company, Atlanta, and is now affiliated with the Bryant Electric Manufacturing Company, Bridgeport, Conn. Mr. Jaudon will be Southern representative of the latter company, stationed in Atlanta.

The Detroit Stoker Company, General Motors Building, Detroit, announces the appointment of E. L. Beckwith as district manager in charge of the company's Chicago office at 230 Clark Street.

The Kant-Kool Electric Water Heater Company, Inc., 22 North Water Street, Odgensburg, N. Y., has been organized with capital stock of $100,000 to manufacture electric water heaters and kindred products. Factory buildings have been obtained, and the company will equip its plant for manufacturing in the the near future.

Mathew Brothers, 1661 West Washington Street, Los Angeles, manufacturers of batteries and other kindred electrical equipment, has purchased a site at 1729 Santee Street for a new plant. It is expected to start work early in 1924.

The Packard Electric Company, Warren, Ohio, has started the erection of a two-story transformer plant, 110 ft. x 220 ft., which will involve the expenditure of $350,000. The present works will be used exclusively for the manufacture of cable. With the new building the company will largely increase its transformer production and will manufacture transformers in capacities up to 7,500 kva.

The International Lamp Corporation, 736 West Monroe Street, Chicago, has purchased the Vitanola plant in Cicero, Ill., and will occupy it for the manufacture of lamps. The building, which is at South Fifty-second Avenue and West Nineteenth Street, has 225,000 sq.ft. of floor space.

The Otis Elevator Company, 2300 Stockton Street, San Francisco, has plans for a two-story factory branch, 135 ft. x 275 ft., estimated to cost $350,000, including machinery.

The Union Electrical Company, Baltimore, has leased the three-story building at Charles Street and Lafayette Avenue for the establishment of a new manufacturing plant.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase and agency are desired in Calcutta, India (No. 7,962), for electrical accessories.

M. F. JACQUET, Rue Saint-Bernard 127, Brussels, Belgium, would like to get in touch with American manufacturers of electrical goods, with a view of acting as their representative in Belgium.

ELECTRIC RECORDING INSTRUMENTS FOR NEW ZEALAND.—Tenders will be received by the Public Works Department, Wellington, New Zealand, until Nov. 27 for electric recording instruments for the Mangahao electric power supply.

HIGH-TENSION APPARATUS FOR SYDNEY, AUSTRALIA.—Tenders will be received by the Municipal Council, Sydney, Australia, until Dec. 31 for high-tension switchgear and apparatus. Tenders will also be received until Jan. 21 by the Town Council for high-tension split conductor feeder panels.

ROTARY CONVERTERS FOR NEW SOUTH WALES, AUSTRALIA.—Tenders will be received by the New South Wales Government Railways and Tramways Commissioners, Sydney, Australia, until Dec. 12 for rotary-converter units.

ELECTRIC PLANTS FOR BALLARAT AND BENDIGO, AUSTRALIA.—Arrangements are being made by the Electric Supply Company, Victoria, Australia, to install electric plants in Ballarat and Bendigo, each plant to be equipped with two 1,000-kw. steam-driven turbo-alternators, which have been purchased in England. The cost of the project is estimated at £70,000.

PROPOSED HYDRO-ELECTRIC SCHEME FOR WINGHAM, AUSTRALIA.—A report has been submitted to the Municipal Council by Armstrong, Whitworth & Company, Ltd., Sydney, Australia, on a proposed hydro-electric power scheme for the district by utilizing the Ellenborough River. The cost is estimated at £50,000.

PROPOSED HYDRO-ELECTRIC PROJECT FOR CZECHOSLOVAKIA.—Official sanction has been secured for the construction of a large dam on the River Thaya in connection with the scheme for harnessing that river to generate electricity. The cost of the project is estimated at 520,000,000 Czech kronen and will require from five to six years to complete.

CONCESSION GRANTED FOR HYDRO-ELECTRIC PLANT IN SPAIN.—A concession for the establishment of a hydro-electric plant on the River Villefria, near Respende de la Pena, Province of Valencia to supply electricity for light and power purposes, has recently been granted by the Spanish government.

New Apparatus and Publications

CO_2 METERS.—The Brown Instrument Company, Philadelphia, has brought out a new indicating and recording CO_2 meter, which works on the principle of the difference in thermal conductivity of various gases.

SAFETY DEVICES.—The Mathias-Hart Company, 101 Halsey Street, Newark, N. J., is distributing a leaflet calling attention to its rubber goods and safety devices for electrical workers.

ELECTRICAL TOOLS.—Mathias Klein & Sons, 3,200 Belmont Avenue, Chicago, is distributing catalog No. 19, covering the "Klein" tools for electricians, linemen and mechanics.

TROUBLE LAMP.—A. B. Stewart & Company, 219 West Huron Street, Chicago, has placed on the market the "Klasp-Tite" trouble lamp.

ELECTRIC TOASTER.—A turn-over electric toaster has been brought out by the Gold Seal Electric Company, 1,270 Ontario Street, Cleveland, Ohio.

TABLE TAP.—The Magnus Electric Company, Inc., 451 Greenwich Street, New York City, has placed on the market a table tap for the connection of several appliances.

ELECTRIC FREEZER.—The Alaska Freezer Company, Lincoln Avenue Extension, Winchendon, Mass., has added a new electric freezer to its line of products.

CORDS AND CABLES.—The Rome Wire Company, Rome, N. Y., has issued a booklet describing and illustrating its "Super-Service" cords and cables.

ELECTRICAL RECORDER.—The Evershed patent 1923 electrical record has recently been placed on the English market by Evershed & Vignoles, Ltd., Chiswick, London, England.

DIE-CASTINGS.—The Doehler Die-Casting Company, Court and Huntington Streets, Brooklyn, N. Y., is distributing a booklet giving a brief review of the manufacture and use of the "Doehler" die castings.

RECIPROCATING SWITCH.—The Arrow Electric Company, Hartford, Conn., has placed on the market a line of single-pole and double-pole reciprocating heater switches.

PORTABLE LAMP.—The Wirt Company, 5,221 Greene Street, Germantown, Philadelphia, brought out a new portable lamp under the name of "Dim-A-Lamp."

ELECTRIC REFRIGERATOR.—A refrigerating machine rated at 50, 75 and 100 lb. has been developed by the Copeland Products, Inc., Flint, Mich.

MACHINE TENDER TRUCK.—A machine tender truck for electricians and contractors has been placed on the market by the Angle Steel Tool Company, Plainwell, Mich.

New Incorporations

THE COMMUNITY POWER & LIGHT COMPANY, Marlin, Tex., has been organized to take over the ice and electric plants in Marlin, Mexia, Lott, Chilton, Rosebud and other towns. The company is capitalized at $1,000,000 and proposes to operate electric, gas, ice and refrigerating plants. The incorporators are T. A. Cheeves, N. D. Naman and George H. Carter.

HISEVILLE (KY.) LIGHT & POWER COMPANY has been incorporated by E. L. Palmer, W. M. Forest and others.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

FRYEBURG, ME.—The property of the Fryeburg Electric Light Company has been purchased by the Western Maine Power Company, Limerick. A new power house, it is understood, will be built at Swans Falls.

WATERVILLE, ME.—The installation of electrically operated machinery at the new pumping station of the Kennebec Water District is under consideration. Metcalf & Eddy, 14 Beacon Street, Boston, are engineers.

PORTSMOUTH, N. H.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 23 for 50,000 attachment plug terminals. (Schedule 1426).

GLASTONBURY, CONN.—The Glastonbury Tobacco Warehouse Company plans to build a power house at its new works to cost about $47,000. Buck & Sheldon, Hartford, are architects.

Middle Atlantic States

BUFFALO, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Oct. 31 for rewiring wards 13, 14, 15, 32, 33 and 34 at the Buffalo State Hospital.

BUFFALO, N. Y.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Nov. 7 for the installation of a magnet electric passenger elevator, etc. For details see Searchlight Section.

PALMYRA, N. Y.—Bids will be received by Edward S. Walsh, Commissioner of Canals and Highways, Capitol, Albany, until Nov. 1 for completion of new power station at Lock No. 29 at Palmyra.

TENAFLY, N. J.—Plans are under consideration for extending the street-lighting system on Oak and Front Streets and other thoroughfares.

ASYLUM, PA.—The Asylum Township Electric Company, recently organized, has applied for permission to install and operate a light and power system in Asylum Township.

CLARKS FERRY, PA.—Frank M. Waring, Tyrone, and associates, have applied to the Federal Power Commission for permission to build a hydro-electric power plant on the Susquehanna River, with transmission system. A company will be organized to carry out the project.

GROVE CITY, PA.—Plans are under consideration for consolidating the municipal power plant with the city waterworks. The plans include a new building and the installation of new equipment.

HANOVER, PA.—The Hanover Power Company is negotiating for the purchase of the property of the Paradise Township York Power Company and plans for extensions to the system.

HYNDMAN, PA.—The Savage Fire Brick Company will install electric power equipment in connection with additions at its local plant and branch refractory works at Williams, and also at its proposed plant at Franklin Junction.

JUNIATA, PA.—The Watts Water & Power Company and the Juniata Water Power Company, recently organized, have secured permission to build a hydro-electric plant on the Juniata River, near Iroquois, to cost about $400,000.

McKEESPORT, PA.—The installation of electrically operated pumps in connection with proposed waterworks extensions, to cost about $230,000, is under consideration.

PHILADELPHIA, PA.—The new woodworking plant of George W. Smith & Company, Inc., Botanic Avenue and Fifty-first Street, will be equipped with electrically driven machinery. The cost is estimated at $200,000.

PITTSBURGH, PA.—The Pittsburgh Reinforced Brazing Company, Liberty Avenue, has filed plans for the construction of a new transformer station at its plant.

PITTSBURGH, PA.—Plans are being prepared by the Pittsburgh Terminal Railroad & Coal Company, Wabash Building, for a substation and a 22,000-volt transmission line from Pittsburgh to Rook, Pa., and to Horning, W. Va.

READING, PA.—The Metropolitan Edison Company has secured permission to build a steel-tower transmission line on Neversink Mountain in connection with its new system from Reading to Shanesville, where connection will be made with the lines between Easton and Shanesville.

SHENANDOAH, PA.—Plans are under consideration for the installation of electrically operated pumping machinery in connection with extensions to the municipal waterworks, to cost about $200,000.

STANDING STONE, PA.—The Standing Stone Township Electric Company, recently organized, has applied for permission to install and operate a system in Standing Stone Township.

WARREN, PA.—The Watson Township Public Service Company and the Cherry Grove Township Public Service Company, recently formed, plan to erect transmission lines. G. C. Savering, Johnstown, is treasurer.

DOVER, DEL.—The Town Council is considering extending the municipal electric system to Cheswold.

BALTIMORE, MD.—The Anthracite Fuel Corporation, 706 Continental Building, recently formed, plans to build a power plant at its proposed local fuel briquette manufacturing plant, to cost about $350,000.

BELINGTON, W. VA.—Plans are being considered for rebuilding the municipal power plant, recently damaged by fire. The loss is estimated at $30,000.

MARLINTON, W. VA.—The Raine Lumber Company contemplates the installation of electrical equipment in its plant at Clover Lick.

MORGANTOWN, W. VA.—Extensions and improvements in the municipal lighting system are under consideration.

WEST UNION, W. VA.—The Midland Electric Service Company, recently organized, has acquired a site on Middle Island Creek, on which it proposes to build an electric power plant. J. Lambert McCormick is interested in the company.

STAUNTON, VA.—Plans are under consideration for the installation of electrically operated pumping machinery at the proposed new municipal waterworks, to cost about $500,000.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Oct. 22 for 2,500 ft. of conduit, 100 switchboard jacks, 100 lamp sockets, 850 lb. of switchboard wire, etc. (Circular C.P. 15890-1.)

WASHINGTON, D. C.—Bids will soon be called by the Bureau of Yards and Docks, Navy Department, for motor-generator, transformers, substation equipment and switchboard, for the Pearl Harbor (H. T.) navy yard (Specification 4924, superseding Specification 4548.)

North Central States

DETROIT, MICH. — The Ford Hydro Electric Company, Highland Park, has applied for permission to construct and operate a hydro-electric plant on the Menominee River, in Florence County, Wis., to cost about $750,000.

DOLLAR BAY, MICH.—The Dollar Bay Lumber Company plans to install additional equipment at its power house.

KINGSTON, MICH.—A special election will be called to vote bonds for extensions in the street-lighting system and for commercial service. The Great Lakes Power Company plans to extend its line from Yale to furnish electricity here.

MARQUETTE, MICH.—The City Council is considering calling a special election to submit the proposal to issue $100,000 in bonds for extensions to the municipal electric plant on the Dead River. Orbison & Orbison, 812 College Avenue, Appleton, Wis., are engineers.

NEWARK, OHIO. — The Ohio Power Company plans to construct an electric plant, to cost about $500,000. Sargent & Lundy, 72 West Adams Street, Chicago, are engineers.

TOLEDO, OHIO.—Electric power equipment will be installed in the proposed local ice and cold-storage plant to be erected by the Baltimore & Ohio Railroad Company, to cost about $2,500,000.

TOLEDO, OHIO. — The Libbey-Owens Sheet Glass Company, Nicholas Building, plans to construct a power house at its proposed new plant, to cost about $1,000,000. The Devore Company, Nicholas Building, is engineer.

TORONTO, OHIO.—The Ohio River Edison Company has been granted permission to construct an electric plant on the Ohio River near Toronto, to cost about $1,000,000.

INDIANAPOLIS, IND. — The Taggart Baking Company, 18 North New Jersey Avenue, plans to erect a power plant at its works on East Market Street.

INDIANAPOLIS, IND.—The Bemis-Indianapolis Bag Company, 1940 Barth Avenue, has filed plans for the erection of a power house at its plant.

SULLIVAN, IND.—The Indiana Electric Corporation, subsidiary of the Central Indiana Power Company, contemplates the erection of a 33,000-volt transmission line from Sullivan to Worthington.

ASHMORE, ILL.—The Central Illinois Public Service Company, Springfield, will install a local street-lighting system. A ten-year franchise has been granted.

CHICAGO, ILL.—Plans have been filed for the erection of an addition to the power house at the Elizabeth Hospital, 1400 Claremont Avenue, to cost about $40,000.

BELGIUM, WIS. — The Village Board has authorized the Badger Public Service Company to install a street-lighting system here. W. N. Albertson, First Wisconsin National Bank Building, Milwaukee, is president.

CEDAR GROVE, WIS. — The Village Board has authorized the Badger Public Service Company to install twenty-two additional street lamps of 250 cp. W. N. Albertson, First Wisconsin National Bank Building, Milwaukee, is president.

CLEVELAND, WIS.—The Badger Public Service Company contemplates changing its local system from direct to alternating current, and also to extend its transmission lines to St. Wendel and Centerville. W. N. Albertson, First Wisconsin National Bank Building, Milwaukee, is president.

EAU CLAIRE, WIS.—Extensive construction work in this district is contemplated by the Northern States Power Company, including a substation at Wissota, to cost about $1,000,000, a number of smaller substations and the erection of high-tension transmission lines. J. N. Clark is manager of the local office of the Byllesby Engineering & Management Corporation, Chicago.

ELCHO, WIS. — The Charles W. Fish Lumber Company is planning to build a power house at its new woodworking plant, to replace a works recently destroyed by fire with loss of about $175,000.

GREEN BAY, WIS.—Arrangements have been made by the Northern Paper Mills Company for a hydro-electric development on the Menominee River, 14 miles from Wausaukee.

MADISON, WIS.—Plans have been completed by the State Capitol Commission for laying underground light and power cables on the Capitol grounds. Electricity will be supplied by the Madison Gas & Electric Company.

MADISON, WIS. — The installation of fifty new street lamps will be recommended to the Board of Estimates by the street-lighting committee.

MARINETTE, WIS. — The question of improving the present (arc-lamp) street-lighting system is under consideration. The installation of ornamental lamps in the business section is being considered.

MARION, WIS.—The Marion Light & Power Company, recently organized with a capital stock of $25,000, plans to establish an electric plant for commercial service. Electricity will be purchased.

NEENAH, WIS. — Petitions have been presented to the City Council asking for extensions and improvements to the present street-lighting system.

RACINE, WIS.—The City Council is considering changing the present street-lighting system on Mead Street and DeKoven Avenue.

RACINE, WIS.—The installation of electrically operated pumping machinery in the proposed addition to the municipal pumping plant is under consideration.

WAUSAUKEE, WIS. — The Wisconsin Public Service Corporation plans to erect a 13,000-volt transmission line from its new generating plant at Johnsons Falls, about 25 miles, to cost about $45,000. A light and power system will be installed at Crivitz, Wis.

WOODMAN, WIS.—The proposal to install an electric distributing system and to erect a transmission line from Wauzeka and to purchase electricity from the Interstate Light & Power Company will be submitted to the voters.

DODGE CENTER, MINN.—The Northwestern Power Company plans to erect additional lines in this section for farm and municipal service.

LITTLE FALLS, MINN.—The Pike Rapids Hydro-Electric Company contemplates the construction of a new hydro-electric plant at Pike Rapids, to cost about $100,000.

MINNEAPOLIS, MINN.—The construction of a power plant, 45 ft. x 75 ft., two stories, at the Norwegian Deaconess Hospital is under consideration.

MINNEAPOLIS, MINN.——The Standard Gas & Electric Company has issued $2,500,000 in notes, part of the proceeds to be used for extensions.

OWATONNA, MINN.—The establishment of a municipal electric light plant is under consideration by the City Council.

ST. PAUL, MINN.—The American Radiator Company, Chicago, plans to install electric power equipment at its proposed plant addition here, to cost about $250,000.

COUNCIL BLUFFS, IOWA.—The Citizens' Gas & Electric Company contemplates extensive additions and improvements in its system, including the installation of new equipment. The company is negotiating for a twenty-five-year franchise.

MANSON, IOWA.—Under the terms of an extension of its franchise the Manson Light, Heat & Power Company agrees to install new equipment in its plant and to change its system from direct to alternating current within the next twelve months.

OSKALOOSA, IOWA.—The Des Moines (Iowa) Electric Company is planning to extend its transmission line from Otley to Oskaloosa. The company has been granted permission to erect its line through Pella.

BOLIVAR, MO.—Frank W. Graham, St. Louis, has applied for a twenty-year franchise in Bolivar. He proposes to construct an electric and water plant.

CAMERON, MO.—Bonds to the amount of $64,500 have been voted for extensions to the municipal electric light plant and lines. Burns & McDonnell, Interstate Building, Kansas City, are engineers.

FARMINGTON, MO.—The installation of electrically operated pumping machinery at the waterworks and sewerage plants, in connection with proposed extensions, to cost $100,000, is under consideration. Charles A. Haskins, Finance Building, Kansas City, is consulting engineer.

MOBERLY, MO.—The Wabash Railway Company, St. Louis, will install electric power equipment in connection with extensions and improvements at its local shops. A. O. Cunningham is chief engineer.

CHAMBERLAIN, S. D.—The plant of the Chamberlain Gas Light & Power Company was recently damaged by fire.

CRETE, NEB.—The construction of an electric light and power plant in Crete is under consideration by the Council.

PIERCE, NEB.—The Nebraska Gas & Electric Company, Norfolk, has taken over the local electric plant of the Pierce Milling Company and plans to extend its transmission line here.

WALTHILL, NEB. — A bond issue of $46,000 is being arranged for the installation of a municipal electric plant and ice factory. The Prince-Nixon Engineering Company, Peters Trust Building, Omaha, is engineer.

Southern States

DAVIDSON, N. C.—The installation of a lighting system in Davidson is under consideration.

ROCKY MOUNT, N. C.—The Atlantic Coast Line Railway Company, Wilmington, plans to install electric substation and power equipment at its proposed local car repair shops, to cost about $100,000.

ARCADIA, S. C.—The Arcadia Mills, Inc., plans to build a power house in connection with extensions at its local textile plant. Lockwood, Greene & Company, Charlotte, N. C., are engineers.

DENMARK, S. C.—Electric power and substation equipment will be installed in the proposed plant of the Denmark Fertilizer Manufacturing Company. A contract for electricity has been made with the Edisto Public Service Company.

ST. PETERSBURG, FLA.—The Pinnellas County Power Company plans to install a light and power system in the Ridgewood Terrace section.

SOUTH JACKSONVILLE, FLA. — An issue of $350,000 in bonds is being considered for extensions and improvements to the electric system, waterworks and sewerage plant.

TALLAHASSEE, FLA. — The citizens have voted to lease the municipal electric plant to the West Florida Power Company for a period of twenty years.

TAMPA, FLA.—The United States Export Chemical Corporation, recently organized, plans to install a substation at its proposed local superphosphate plant, to cost about $350,000. Harry A. Pierce is vice-president in charge.

BIRMINGHAM, ALA.—Steps have been taken by the Civitan Club for the installation of ornamental lamps on Fifth Avenue from the main part of the city to the Union Station.

BIRMINGHAM, ALA. — The Alabama Power Company has been granted permission to erect a power transmission line from Montgomery to Greenville.

FLORENCE, ALA.—Steps are being taken for the installation of an electric pumping plant for the municipal waterworks, to replace the present steam-driven equipment.

BOSSIER CITY, LA.——Plans are being arranged for the installation of electrically operated pumping machinery in connection with a proposed waterworks and sewerage system, to cost about $125,000.

VERBENA, ALA.—B. J. Baldwin is organizing a company to construct and operate an electric plant for local commercial service, to cost about $75,000.

HIRAM, ARK.—The Big Creek Power Company, it is understood, will soon ask for bids for the construction of a dam, two turbines, two 75-kw. generators with exciters, transformers, etc., and for 3½ miles of transmission line. The cost is estimated at about $44,000.

SHREVEPORT, LA.—Plans are under way for the installation of electrically operated pumping machinery at the municipal waterworks, to cost about $200,000, in connection with extensions to the waterworks system, for which $1,000,000 in bonds has been voted.

HOLDENVILLE, OKLA. — Plans are under way for the installation of electrically operated pumping machinery in connection with extensions in the municipal waterworks, to cost about $50,000.

WYNNEWOOD, OKLA.—The municipal electric plant has been taken over by the Oklahoma Gas & Electric Company. The company proposes to extend its transmission lines to furnish electricity here.

LUBBOCK, TEX.—Plans are being arranged for a bond issue of $100,000, one-half of which will be used for extensions to the municipal electric power plant, and the remainder for extensions in the municipal light and conduit systems.

MARLIN, TEX.—The Community Power & Light Company contemplates improvements to its plants at Marlin, Chilton, Rosebud, Mart, Mexia, Reisel and Lott, to cost about $500,000.

SAN BENITO, TEX.—The Valley Ice & Electric Company has authorized the construction of a transmission line in the lower Rio Grande Valley section, for light and power service in a number of communities.

VERNON, TEX.—The Waggoner Ranch Corporation, recently formed, plans to build an electric plant to cost about $60,000, for commercial power and light service in connection with the development of its property.

Pacific and Mountain States

COLBERT, WASH.—The Mount Spokane Power Company, Milan, plans to erect a transmission line from Chattaroy to Colbert, about 25 miles. A number of branch lines will be built for light and power service to different communities.

SEATTLE, WASH. — The Puget Sound Power & Light Company has been granted a number of permits for extensions in its transmission lines in the county.

TACOMA, WASH.—An ordinance is being arranged for the installation of an ornamental street-lighting system on South Thirty-eighth Street.

NEWPORT, ORE.—Plans are under consideration for the installation of electrically operated pumping machinery in connection with extensions in the municipal waterworks. P. W. Peasley, 603 Railway Exchange Building, Portland, is engineer.

ROSEBURG, ORE. — The California Oregon Power Company, San Francisco, has applied for a temporary permit covering a proposed hydro-electric development on the North Umpqua River. The application covers four units, the first at Lemola Falls, near Diamond Lake; the second at Ireland Falls, the third and fourth units to take in all the river from Steamboat Creek to the Narrows, near Idlyld Park.

BISHOP, CAL.—The Owens Valley Irrigation District plans extensions to its system, including the installation of electric power and pumping equipment. Bonds for $1,650,000 have been approved.

FORT MASON, CAL.—Bids will be received by the Constructing Quartermaster, United States Army, until Nov. 5 for motor, pump and auxiliary equipment for the pumping plant at Presidio, San Francisco.

LOS ANGELES, CAL.—Bids will be received by the Department of Public Service until Oct. 23 for high-voltage transformers (Specification P-314); also, for 35,000-volt lightning arresters (Specification P-317). James P. Vroman is secretary.

LOS ANGELES, CAL.—The Climax Engineering Company, Clinton, Iowa, manufacturer of refrigerating machinery, contemplates the construction of a power house at its proposed local plant, to cost about $115,000.

MILLBRAE, CAL.—The West Coast Porcelain Company will install electric power equipment at its plant in connection with proposed additions, to cost about $500,000.

OCEANSIDE, CAL.—Plans are being considered for the installation of electrically operated pumping machinery in connection with a new municipal waterworks system, to cost $80,000.

ORLAND, CAL.—The purchase of the local system of the Pacific Gas & Electric Company, to be operated by the municipality, is under consideration. It is proposed to purchase electricity from the company.

OXNARD, CAL.—The Ord Ice Company will install electric power equipment at its proposed ice-manufacturing plant at the foot of Enterprise Street, to cost about $75,000.

REDWOOD CITY, CAL. — The Pacific Portland Cement Company, Pacific Building, San Francisco, plans for the construction of a power plant at its proposed local mill, estimated to cost in excess of $750,000, with machinery.

SAN FRANCISCO, CAL. — The Great Western Power Company is considering an issue of $1,000,000 in bonds, the entire proceeds to be used for extensions and improvements to its system.

SAN FRANCISCO, CAL.—The Board of Supervisors of the city and San Francisco County have voted for the municipal distribution of electricity generated at the Hetch Hetchy project. M. M. O'Shaughnessy, city engineer, has been instructed to prepare plans.

SAN FRANCISCO, CAL.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 23, for 5,000 ft. of light and power wiring for the Mare Island navy yard (Schedule 1416.)

SANTA BARBARA, CAL.—A site has been acquired in Santa Barbara by the Southern California Edison Company on which it will erect a new transformer station, to cost about $150,000. The present transformer station on Castillo Street, near the carbarns, will be dismantled.

WOODLAND, CAL.—The Union Ice Company will install electric power equipment in its proposed local ice-manufacturing plant.

EMMETT, IDAHO.—Plans are being prepared for the construction of a hydro-electric plant at the Black Canyon Dam, to cost about $150,000. F. E. Weymouth, Boise, is engineer in charge.

TUCSON, ARIZ.—The Board of Directors, University of Arizona, plans to purchase equipment in connection with the establishment of an electrical engineering department at the institution. Professor Paul Cloke is head of the department.

NACO, ARIZ.—Frank J. Keogh, Naco, has applied for a certificate of convenience and necessity to build and operate an electric power plant to furnish electricity in the town of Naco.

CASPER, WYO.—The installation of electrically operated pumping machinery at the proposed new municipal waterworks is under consideration. Black & Veatch, Mutual Building, Kansas City, Mo., are engineers.

DENVER, COL.—A building permit has been issued by the city to the Public Service Company of Colorado for the construction of an automatic substation at Thirty-ninth and Columbine Streets.

Canada

CHEMAINUS, B. C.—The Weyerhauser Timber Company, Tacoma, Wash., plans to construct a power plant at its proposed local lumber mill, to cost about $1,200,000.

FORT WILLIAM, ONT. — The Great Lakes Pulp & Paper Company plans to build a power plant at its proposed new pulp and paper mill, to cost about $2,000,000.

HAMILTON, ONT. — The City Council has appropriated $14,000 for placing power transmission lines underground.

HAMILTON, ONT. — The Hamilton Hydro-Electric System contemplates the construction of a substation on the Beach Road, to cost about $40,000.

QUEBEC, QUE.—The Lower St. Lawrence Power Company has been granted permission by the Public Service Commission to erect a transmission line in the town of Matane.

MELVILLE, SASK.—The municipal electric plant was recently destroyed by fire, causing a loss of about $100,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued Oct. 2, 1923)

15,693 (reissue). TROLLEY WHEEL; O. Moore, Frankfort, Ind. App. filed March 26, 1919. Automatic sliding and rotating trolley wheel for use on electric cars.

1,469,208. SWITCHBOARD LAMP; E. A. Bohlman, Chicago, Ill. App. filed Feb. 14, 1921. Improved terminal strip for switchboard lamp.

1,469,210. MOTOR-CONTROL SYSTEM; A. H. Candee, Forest Hills, Pa. App. filed Nov. 29, 1920. For motors operating brooms of snow sweepers.

1,469,213. CONSTANT-CURRENT TRANSFORMERS; W. E. Douglass, Wilkinsburg, Pa. App. filed July 12, 1917. Moving-coil type.

1,469,253. CARRIER TELEGRAPH CIRCUITS; R. W. Deardorff, Brooklyn, N. Y. App. filed Oct. 21, 1920. Ordinary telegraph subscriber's circuit with channels of carrier system.

1,469,254. CARRIER TELEGRAPH CIRCUITS; R. W. Deardorff, Brooklyn, N. Y. App. filed Oct. 21, 1920. Means for associating local telegraph circuit loop with channels of carrier telegraph system.

1,469,259. CARRIER TELEGRAPH CIRCUITS; B. P. Hamilton, Brooklyn, N. Y. App. filed Oct. 21, 1920. Loop circuit used to transmit current to transmission line.

1,469,260. CARRIER TELEGRAPH CIRCUITS; B. P. Hamilton, Brooklyn, N. Y. App. filed Oct. 21, 1920. Relates to repeater apparatus.

1,469,264. REGENERATIVE BRAKING SYSTEM FOR ELECTRICALLY DRIVEN VEHICLES; H. Lübeck, Herserud, Sweden. App. filed Dec. 28, 1918. For vehicle driven by storage battery.

1,469,271. TESTING SYSTEM; H. Fletcher, New York, N. Y. App. filed Oct. 19, 1922. For determining efficiency of telephone transmitters.

1,469,295. ADAPTER; H. P. Donle, Meriden, Conn. App. filed Jan. 19, 1920. App. filed Jan. 19, 1920. For electron tubes.

1,469,302. MULTIPLE BOND FOR SIGNAL SERVICE TRACK-CIRCUIT RAILS; C. O. Harrington, Chicago, Ill. App. filed Sept. 24, 1920.

1,469,328. CIRCUIT ARRANGEMENT FOR RECEIVING RADIO ENERGY; E. Mayer and A. Leib, Berlin, Germany. App. filed Aug. 3, 1922.

1,469,337. BACKING ALARM AND SIGNAL FOR AUTOMOBILES; E. M. Sanborn, Oakland, Cal. App. filed July 14, 1919. Rear direction signal.

1,469,349. RADIO CONTROL SYSTEM; A. L. Wilson, Edgewood, Pa. App. filed April 1, 1921. Remote control of distant equipment.

1,469,400. DIRECT-CURRENT RELAY COMPENSATING COIL; A. R. Whitehorn, Downers Grove, Ill. App. filed March 5, 1921. For relays used in track signal systems.

1,469,418. APPARATUS FOR OPERATING DIRECT-CURRENT THREE-MAIN SUPPLY CIRCUITS BY MEANS OF METAL VAPOR RECTIFIERS; J. Kubler, Baden, Switzerland. App. filed Aug. 31, 1921. Main rectifier for feeding outer mains of three-wire circuit and two auxiliary rectifiers which supply part voltages.

1,469,438. ELECTRICAL APPARATUS FOR THE LOCAL AND DISTANT REPETITION OF MOVEMENTS; J. F. Gill and J. N. Chaviara, Liverpool, England. App. filed March 1, 1920. Step-by-step mechanism.

1,469,458. KINETIC HEAT INSULATION; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed Aug. 18, 1921. Electric oven.

1,469,469. METHOD OF AND MEANS FOR APPLYING THE INSULATION OF HIGH-TENSION COILS; S. R. Wright, Rawdon, England. App. filed Aug. 22, 1921.

1,469,471. ELECTROTHERAPEUTIC APPARATUS; E. Aba, Los Angeles, Cal. App. filed Nov. 12, 1921. Casing for high-frequency induction coil or resonator.

1,469,481. VEHICLE SIGNAL; P. J. Messer, Olean, N. Y. App. filed Nov. 7, 1919. Direction signal visible from front or rear.

1,469,558. INDUCTION WATTMETER; J. Harris, Lafayette, Ind. App. filed Jan. 26, 1920. For three-wire alternating-current system.

1,469,561. SIGNAL RECORDING AND TRANSCRIBING METHOD AND APPARATUS; M. R. Hutchinson, West Orange, N. J. App. filed Jan. 21, 1920.

1,469,582. IGNITION SYSTEM; E. G. Buresch, Chicago, Ill. App. filed Dec. 30, 1921.

1,469,584. TUBE-FORMING MACHINE; F. M. Case, Cleveland, Ohio. App. filed Dec. 30, 1921. For making porcelain insulating tubes.

1,469,588. ELECTRICAL HEATING DEVICE; P. E. Onwiler, Billings, Mont. App. filed Aug. 28, 1922. Water heater placed directly in pipe line.

1,469,603. LAWN MOWER; J. W. Peters, Roslyn, N. Y. App. filed March 2, 1921. Driven by electric motor.

1,469,626. ELECTRIC HEATING SYSTEM; J. W. Dorsey, Winnipeg, Manitoba, Canada. App. filed Sept. 18, 1920. Garment electrically heated.

1,469,652. SAFETY DEVICE; W. E. James, Beards Fork, W. Va. App. filed July 12, 1922. Fusible nip to protect gathering reel cable of electric motors and coal-cutting machines used in mines.

1,469,654. ELECTRIC CLIPPER; M. H. Kotzebue, Tulsa, Okla. App. filed March 16, 1920. Hair clippers electrically operated.

1,469,672. CAR-CONTROLLED TROLLEY-LINE CUT-OUT; J. H. Miller, MacDunn, W. Va. App. filed Oct. 5, 1922. For mine railway system.

1,469,720. BRUSH RIGGING; F. F. Dorsey, Rochester, N. Y. App. filed Dec. 31, 1921. For small electric motors.

1,469,727. THERMOSTATIC SWITCHING DEVICE FOR ELECTRIC IRONS; F. Jermin, Alpena, Mich. App. filed March 14, 1922.

1,469,736. STORAGE-BATTERY SYSTEM; R. H. Sullivan, Rochester, N. Y. App. filed May 4, 1922. Charging equipment for automobiles.